

**Cell 1 Regional Coastal Monitoring Programme  
Analytical Report 13: 'Full Measures' Survey 2020**



**Redcar and Cleveland  
Borough Council**

**February 2021**

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## Abbreviations and Acronyms

Acronym / Abbreviation	Definition
AONB	Area of Outstanding Natural Beauty
DGM	Digital Ground Model
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MHWN	Mean High Water Neap
MHWS	Mean High Water Spring
MLWS	Mean Low Water Neap
MLWS	Mean Low Water Spring
m	Metres
ODN	Ordnance Datum Newlyn

## Water Levels Used in Interpretation of Changes

Water Level Parameter	Water Level (m AOD)			
	Hartlepool Headland to Saltburn Scar	Skinningrove	Hummersea Scar to Sandsend Ness	Sandsend Ness to Saltwick Nab
HAT	3.25	3.18	3.15	3.10
MHWS	2.65	2.68	2.65	2.60
MLWS	-1.95	-2.13	-2.15	-2.20
Water Level Parameter	Water Level (m AOD)			
	Saltwick Nab to Hundale Point	Hundale Point to White Nab	White Nab to Filey Brigg	Filey Brigg to Flamborough Head
HAT	3.10	3.05	3.05	3.10
MHWS	2.60	2.45	2.45	2.50
MLWS	-2.20	-2.35	-2.35	-2.30

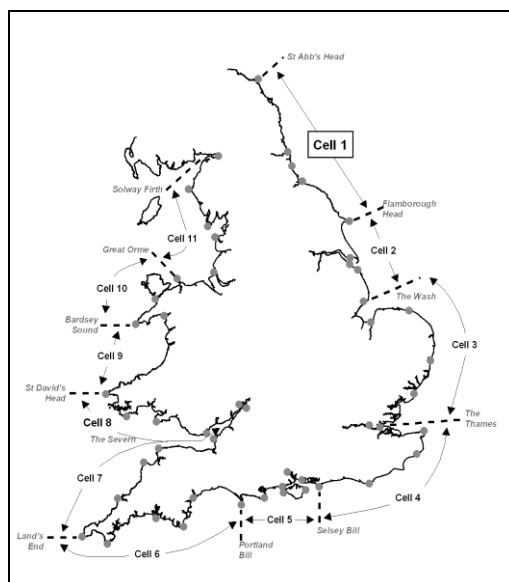
**Source:** *River Tyne to Flamborough Head Shoreline Management Plan 2.*  
Royal Haskoning, February 2007.

## Glossary of Terms

Term	Definition
Beach nourishment	Artificial process of replenishing a beach with material from another source.
Berm crest	Ridge of sand or gravel deposited by wave action on the shore just above the normal high water mark.
Breaker zone	Area in the sea where the waves break.
Coastal squeeze	The reduction in habitat area which can arise if the natural landward migration of a habitat under sea level rise is prevented by the fixing of the high water mark, e.g. a sea wall.
Downdrift	Direction of alongshore movement of beach materials.
Ebb-tide	The falling tide, part of the tidal cycle between high water and the next low water.
Fetch	Length of water over which a given wind has blown that determines the size of the waves produced.
Flood-tide	Rising tide, part of the tidal cycle between low water and the next high water.
Foreshore	Zone between the high water and low water marks, also known as the intertidal zone.
Geomorphology	The branch of physical geography/geology which deals with the form of the Earth, the general configuration of its surface, the distribution of the land, water, etc.
Groyne	Shore protection structure built perpendicular to the shore; designed to trap sediment.
Mean High Water (MHW)	The average of all high waters observed over a sufficiently long period.
Mean Low Water (MLW)	The average of all low waters observed over a sufficiently long period.
Mean Sea Level (MSL)	Average height of the sea surface over a 19-year period.
Offshore zone	Extends from the low water mark to a water depth of about 15 m and is permanently covered with water.
Storm surge	A rise in the sea surface on an open coast, resulting from a storm.
Swell	Waves that have travelled out of the area in which they were generated.
Tidal prism	The volume of water within the estuary between the level of high and low tide, typically taken for mean spring tides.
Tide	Periodic rising and falling of large bodies of water resulting from the gravitational attraction of the moon and sun acting on the rotating earth.
Topography	Configuration of a surface including its relief and the position of its natural and man-made features.
Transgression	The landward movement of the shoreline in response to a rise in relative sea level.
Updrift	Direction opposite to the predominant movement of longshore transport.
Wave direction	Direction from which a wave approaches.
Wave refraction	Process by which the direction of approach of a wave changes as it moves into shallow water.

## Preamble

The Cell 1 Regional Coastal Monitoring Programme covers approximately 300km of the north east coastline, from the Scottish Border (just south of St. Abb's Head) to Flamborough Head in East Yorkshire. This coastline is often referred to as 'Coastal Sediment Cell 1' in England and Wales (Figure 1). Within this frontage, the coastal landforms vary considerably, comprising low-lying tidal flats with fringing salt marshes, hard rock cliffs that are mantled with glacial sediment to varying thicknesses, softer rock cliffs and extensive landslide complexes.



**Figure 1 Sediment Cells in England and Wales**

The work commenced with a three-year monitoring programme in September 2008 that was managed by Scarborough Borough Council on behalf of the North East Coastal Group. This initial phase has been followed by a five-year programme of work, which started in October 2011. The work is funded by the Environment Agency, working in partnership with the following organisations:



The main elements of the Cell 1 Regional Coastal Monitoring Programme involve:

- beach profile surveys
- topographic surveys
- cliff top recession surveys
- real-time wave data collection
- bathymetric and sea bed characterisation surveys
- aerial photography
- LiDAR Surveys
- walk-over cliff and coastal defence asset surveys

The beach profile surveys, topographic surveys and cliff top recession surveys are undertaken as a 'Full Measures' survey in autumn/early winter every year. Some of these surveys are then repeated the following spring as part of a 'Partial Measures' survey.

Each year, an Analytical Report is produced for each individual authority, providing a detailed analysis and interpretation of the 'Full Measures' surveys. This is followed by a brief Update Report for each individual authority, providing ongoing findings from the 'Partial Measures' surveys.

Annually, a Cell 1 Overview Report is also produced. This provides a region-wide summary of the main findings relating to trends and interactions along the entire Cell 1 frontage. To date the following reports have been produced:

**Table 1 Analytical, Update and Overview Reports Produced to Date**

Year		Full Measures		Partial Measures		Cell 1 Overview Report
		Survey	Analytical Report	Survey	Update Report	
1	2008/09	Sep-Dec 08	May 09	Mar-May 09		-
2	2009/10	Sep-Dec 09	Mar 10	Feb-Mar 10	Jul 10	-
3	2010/11	Aug-Nov 10	Feb 11	Feb-Apr 11	Aug 11	Sep 11
4	2011/12	Sep-Oct 11	Oct 12	Mar-May 12	Feb 13	
5	2012/13	Sep 12	Mar 13	Feb- Mar 13	May 13	
6	2013/14	Oct-Nov 13	Feb 14	Mar-Apr 14	Jul 14	
7	2014/15	Sep-Oct 14	Feb 15	Mar-Apr	Jul 15	
8	2015/16	Sep-Oct 15	Feb 16	Mar 16	Jul 16	Jun 16
9	2016/17	Sep-Nov 16	Feb 17	Mar 17	Jul 17	
10	2017/18	Oct 17	Mar 18	Mar-May 18	Jun 18	
11	2018/19	Sep 18	Mar 19	Mar-Apr 19	May 19	
12	2019/20	Oct & Nov 19	Jan 20	Mar-May 20	Aug 20	
13	2020/21	Oct – Dec 20	Feb 21 (*)			

\* The present report is **Analytical Report 13** and provides an analysis of the 2019 Full Measures survey for Redcar and Cleveland Borough Council's frontage.

In addition, separate reports are produced for other elements of the programme as and when specific components are undertaken, such as wave data collection, bathymetric and sea bed sediment data collection, aerial photography, and walk-over visual inspections.

For purposes of analysis, the Cell 1 frontage has been split into the sections listed in Table 2.

**Table 2 Sub-divisions of the Cell 1 Coastline**

<b>Authority</b>	<b>Zone</b>
Northumberland County Council	Spittal A
	Spittal B
	Goswick Sands
	Holy Island
	Bamburgh
	Beadnell Village
	Beadnell Bay
	Embelton Bay
	Boulmer
	Alnmouth Bay
	High Hauxley and Druridge Bay
	Lynemouth Bay
	Newbiggin Bay
	Cambois Bay
Blyth South Beach	
North Tyneside Council	Whitley Sands
	Cullercoats Bay
	Tynemouth Long Sands
	King Edward's Bay
South Tyneside Council	Littehaven Beach
	Herd Sands
	Trow Quarry (incl. Frenchman's Bay)
	Marsden Bay
Sunderland Council	Whitburn Bay
	Harbour and Docks
	Hendon to Ryhope (incl. Halliwell Banks)
Durham County Council	Featherbed Rocks
	Seaham
	Blast Beach
	Hawthorn Hive
	Blackhall Colliery
Hartlepool Borough Council	North Sands
	Headland
	Middleton
	Hartlepool Bay
Redcar & Cleveland Borough Council	Coatham Sands
	Redcar Sands
	Marske Sands
	Saltburn Sands
	Cattersty Sands (Skinningrove)
Scarborough Borough Council	Staithes
	Runswick Bay
	Sandsend Beach, Uppang Beach and Whitby Sands
	Robin Hood's Bay
	Scarborough North Bay
	Scarborough South Bay
	Cayton Bay
	Filey Bay



# 1. Introduction

## 1.1 Study Area

Redcar & Cleveland Borough Council's frontage extends from the South Gare breakwater at the mouth of the River Tees to Cowbar Nab, Staithes. For the purposes of this report, report and for consistency with previous reporting, it has been sub-divided into six areas, namely:

- Coatham Sands
- Redcar Sands
- Marske Sands
- Saltburn Sands
- Cattersty Sands (Skinningrove)
- Staithes

The Staithes frontage straddles the boundary of jurisdiction of Redcar & Cleveland Council and Scarborough Borough Council and therefore reporting has been duplicated in both reports.

## 1.2 Methodology

Along Redcar & Cleveland Borough Council's frontage, the following surveying is undertaken:

- Full Measures survey annually (since 2008) each autumn/early winter comprising:
  - Beach profile surveys along nine transect lines
  - Topographic survey along Coatham Sands
  - Topographic survey along Redcar Sands
  - Topographic survey along Marske Sands
  - Topographic survey along Saltburn Sands
  - Topographic survey along Cattersty Sands
  
- Partial Measures survey annually each spring (since 2009) comprising:
  - Beach profile surveys along nine transect lines
  - Topographic survey along Redcar Sands
  - Topographic survey along Saltburn Sands
  - Topographic survey along Cattersty Sands
  
- Cliff top survey annually at:
  - Staithes

The Full Measures survey was undertaken along this frontage between October and November 2020. The weather and sea state varied, for further details please refer to the Survey Report from Academy Geomatics.

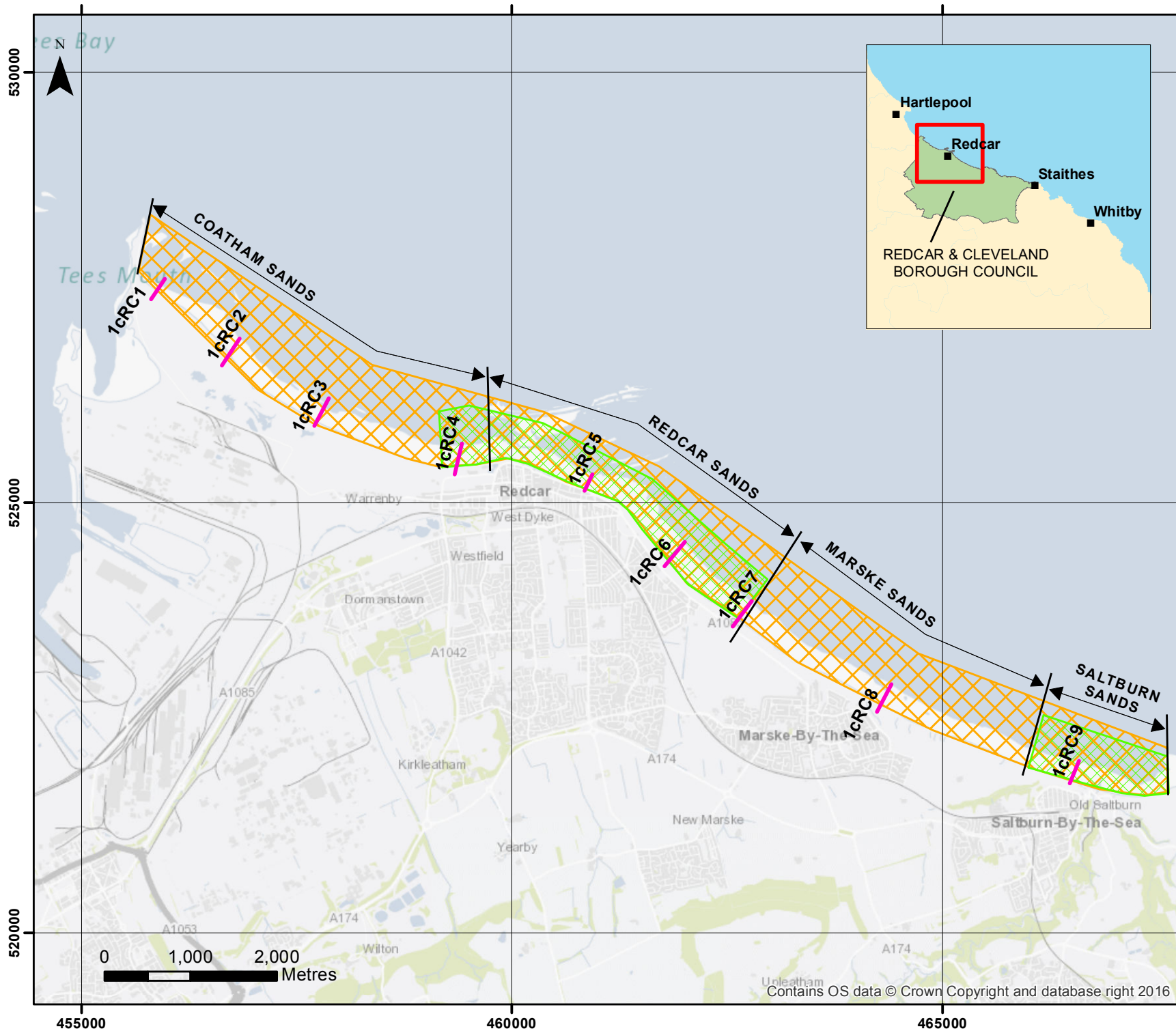
All data have been captured in a manner commensurate with the principles of the Environment Agency's *National Standard Contract and Specification for Surveying Services* and stored in a file format compatible with the software systems being used for the data analysis, namely SANDS and ArcGIS. This data collection approach and file format is comparable to that being used on other regional coastal monitoring programmes, such as in the South East and South West of England.

Upon receipt of the data from the survey team, they are quality assured and then uploaded onto the programme's website for storage and availability to others and also input to SANDS and GIS for subsequent analysis.

The Analytical Report is then produced following a standard structure for each authority. This involves:

- description of the changes observed since the previous survey and an interpretation of the drivers of these changes (Section 2);
- documentation of any problems encountered during surveying or uncertainties inherent in the analysis (Section 3);
- recommendations for 'fine-tuning' the programme to enhance its outputs (Section 4); and
- providing key conclusions and highlighting any areas of concern (Section 5).

Data from the present survey are presented in a processed form in the Appendices.



Key

**SURVEY LOCATIONS**

**Topographic Profiles**

- Annual
- Bi-Annual

**Topographic Surveys**

- 6 monthly
- yearly
- 5 yearly

*(Indicative Survey Extents shown)*

Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme

**Figure 2 - Map 1**

**Redcar & Cleveland Borough Council Frontage**

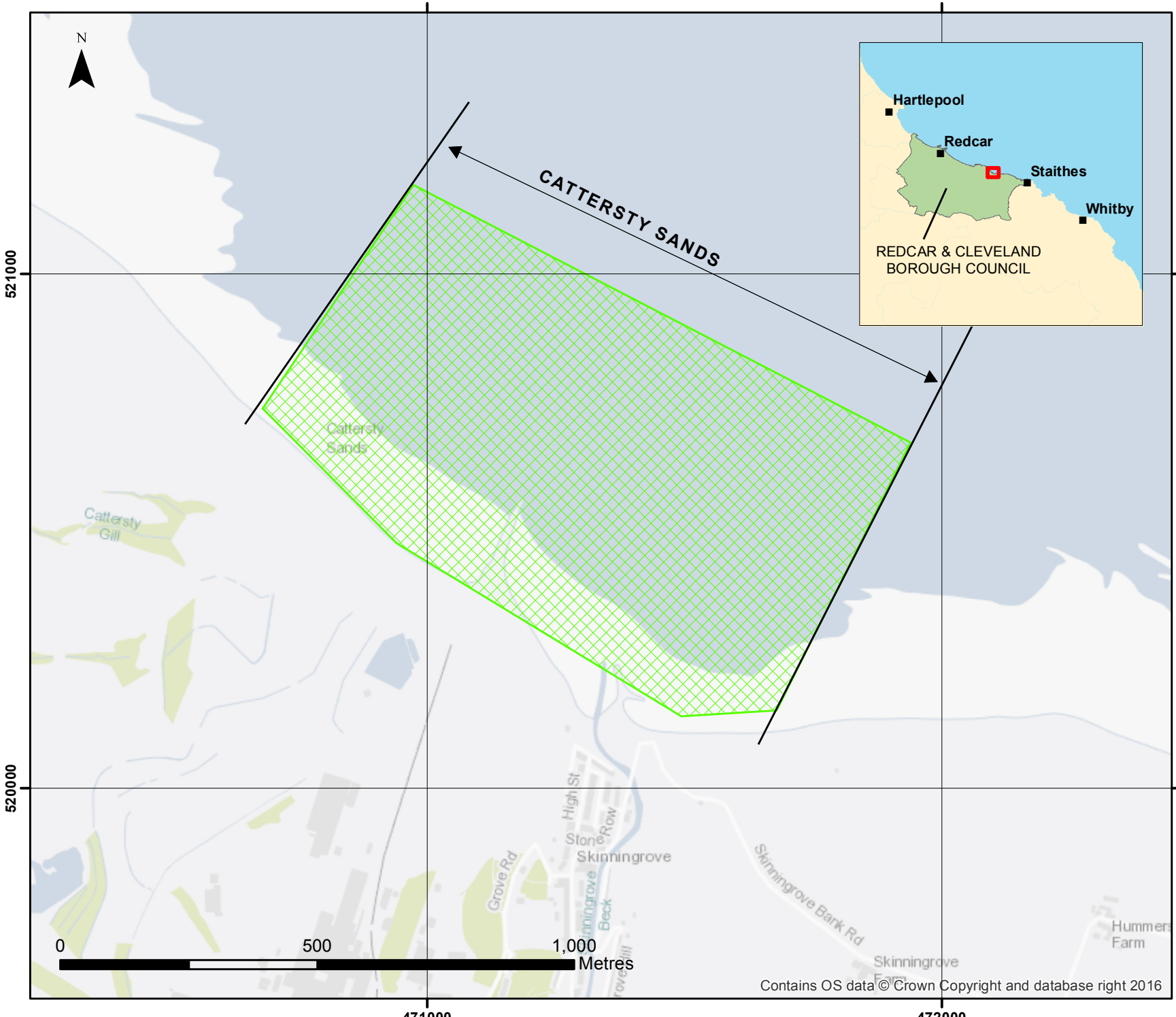
Analytical Report  
 Topo Surveys

Drawing Scale at A4 1:60,000

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Key

**SURVEY LOCATIONS**

**Topographic Profiles**

- Annual
- Bi-Annual

**Topographic Surveys**

- 6 monthly
- yearly
- 5 yearly

*(Indicative Survey Extents shown)*

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

**Figure 2 - Map 2**

**Redcar & Cleveland Borough Council Frontage**

Analytical Report  
Topo Surveys

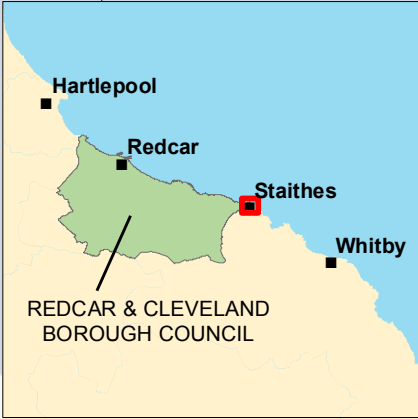
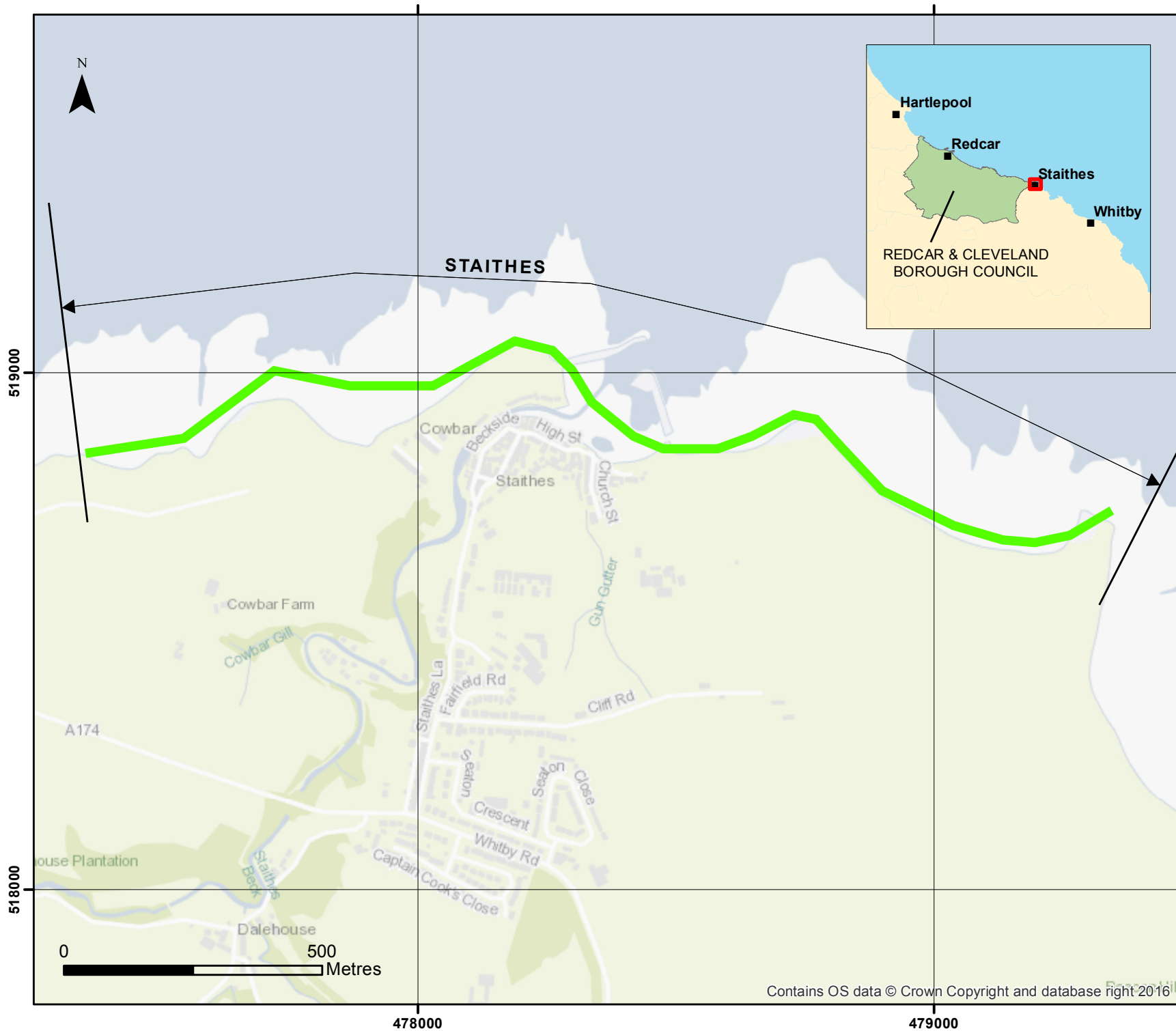
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Key

**SURVEY LOCATIONS**

**Frequency**

- @ 50
- @ 100
- @ 300

*(Indicative Survey Extents shown)*

Client: North East Coastal Group  
Project: Cell 1 Regional Coastal Monitoring Programme

**Figure 2 - Map 3**

**Redcar & Cleveland  
Borough Council  
Frontage**

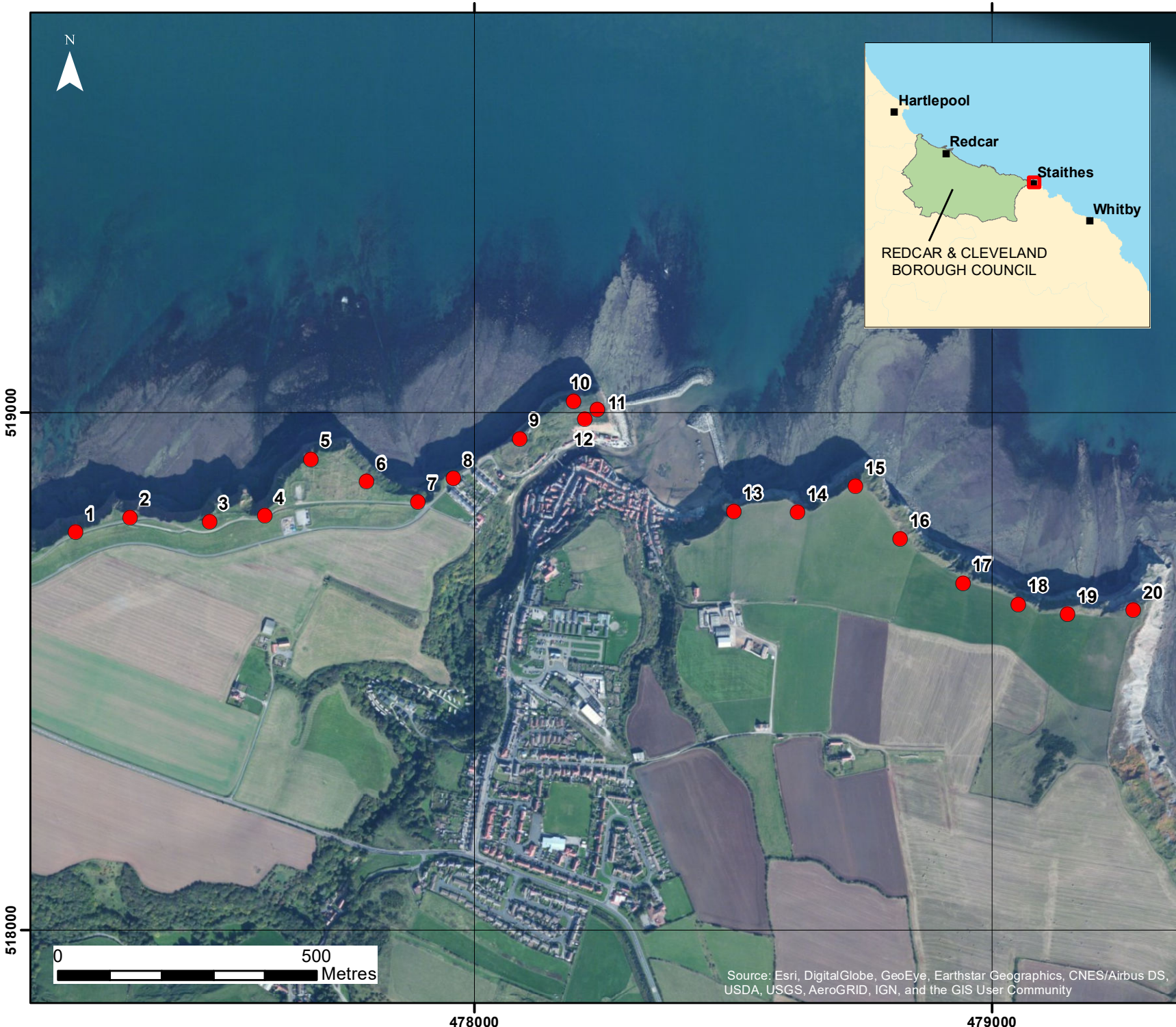
Analytical Report  
Topo Surveys

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**Key**  
 ● Cliff Top Survey Locations

Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme

**Figure 3 - Map 1**

**STAITHES**

**Redcar and Cleveland Borough Council Council Frontage**

Cliff Top Survey Locations

Drawing Scale at A4 1:10,000

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Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

## 2. Analysis of Survey Data

### 2.1 Coatham Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
4 <sup>th</sup> November 2020	<p><b>Beach Profiles:</b></p> <p>Coatham Sands is covered by four beach profile lines during the Full Measures survey (RC1 to RC4; Appendix A).</p> <p>Profile <b>1cRC1</b> is located approximately 300m south of the South Gare breakwater, in the lee of the German Charlies slag banks. The upper profile is dominated by dune ridges, which have remained stable since the 2009 surveys. The foredune has undergone accretion of 0.3m at its crest. There has been accretion from the toe of the dunes at chainage 107m to chainage 171m of up to 0.4m. This has caused a smoothing of the beach profile in its upper and mid reaches. From chainage 171m to chainage 187m a narrow mid-beach berm has been eroded leading to a drop in the beach level here of 0.2m. Seawards from this point up to chainage 252m a low level of accretion has increased the lower-mid beach level by up to 0.2m. From this point to chainage 276m the trend is reversed, and erosion has led to a reduction in the level by up to 0.2m. Whereas the toe of the profile, between chainage 276m and the end of the survey at chainage 298m has experienced accretion of up to 0.5m in level. This has led to a seaward extension of the toe by 15m. Overall these changes have smoothed the profile when compared with the previous Partial Measures survey. The beach level remains high compared to the range recorded from previous surveys. The profile is at its highest recorded level in three locations; on the foredunes from chainage 78m to 107m, at the toe of the foredune from chainage 107m to 114m and on the mid-beach from chainage 192m to 234m.</p> <p>At Profile <b>1cRC2</b>, the dunes continue to remain stable. Over the summer of 2020, the foredunes have experienced up to 0.4m of accretion in level, most notably at the crest of the foremost dune. The seaward face of the foredune has also experience significant accretion of up to 0.4m in level. At the toe of the foredune from chainage 98m to chainage 135m there has been accretion leading to an increase in level of 0.2m. Across the remainder of the beach the profile has remained largely unchanged. Two small upper beach berms which were recorded in the Spring 2020 survey have been eroded and the profile now has a consistent, shallow gradient across its entirety. A small degree of erosion on the mid-beach has seen levels, between chainage 220m and 260m, drop by 0.1m. At the seaward end of the</p>	<p>Overall, the dunes have remained stable at Coatham Sands since the previous partial measures survey. Whilst the beach profiles show that accretion has been the dominant process over the intervening period, covering the summer of 2020, there has been some low levels of erosion in the two southernmost profiles (1cRC3 and 1cRC4).</p> <p>The topographic survey difference plots show a similar trend, with accretion being the dominant process, particularly over the central swathe of the survey extent. There are however two areas of erosion, the southernmost area has been identified in beach profile 1cRC4. The northernmost area of erosion is located slightly to the south east of the location of 1cRC1 and as such was not identified in the beach profile surveys. Generally, erosion has been constrained to the lower beach, however in the south of the survey extent there has been some erosion on the upper beach.</p> <p><b>Longer term trends:</b> The beach profile surveys indicate that the magnitude of change over summer 2020 has been low and is in line with the range of previously recorded results.</p> <p>The topographic survey difference plot has identified an area of erosion in the north west of the survey area, however this is generally contained on the lower</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>profile, from chainage 340m to the end of the survey at chainage 385m there has been accretion, increasing the level of the beach by up to 0.4m at the toe of the profile. The profile is at a high level when compared with the range recorded in previous surveys. Most notably on the foredune where the profile is at its highest recorded level between chainage 77m and chainage 105m.</p> <p>Profile <b>1cRRC3</b> shows stable dunes with some accretion leading to an increase in level of up to 0.3m at the crest of the foredune. There has been a small degree of erosion on the seaward face of the foredune, although this has only resulted in a small reduction in level limited to between 0.1m and 0.2m from chainage 47m and chainage 55m. From the toe of the dune at chainage 55m across the upper and mid – beach to chainage 225m the profile has experienced accretion raising the beach level by 0.3m. Between chainage 225m and 255m there has been a small degree of erosion leading to a reduction in level of 0.2m. Seawards from this point to chainage 307m a lower beach berm has formed increasing the level of the profile by 0.3m between chainage 255m and 308m. At the seaward toe of the profile, from chainage 308m to the end of the survey at chainage 340m, erosion has led to a reduction in level of 0.3m. Overall, the profile is at a medium to high level when compared with the range recorded from previous surveys. The only exception to this is at the crest of the foredune, between chainage 31m and chainage 40m, where the profile is at its highest recorded level.</p> <p>Profile <b>1cRRC4</b> is the beginning of the defended section at Redcar. There has been accretion against the seawall from chainage 11m to 16m increasing the beach level by 0.4m directly along the face of the seawall. On the upper beach, from chainage 16m to chainage 40m erosion has caused the beach levels to drop by 0.2m. This material has been drawn down and formed a shallow berm between chainage 40m and chainage 70m. The remainder of the profile from chainage 70m until the end of the survey at chainage 340m has experienced consistent erosion, decreasing beach levels by between 0.1m and 0.2m. Overall the profile is at a high level on the upper beach, a medium level on the mid-beach and a low level on the lower beach, when compared with the range recorded from previous surveys. The profile is at its highest recorded level between chainage 47m and 57m and its lowest level between chainage 225m and 328m.</p>	<p>and mid-beach. The changes recorded in Autumn 2020 are in line with those recorded in previous surveys.</p>
<p><b>November 2020</b></p>	<p><b>Topographic Survey:</b></p> <p>Coatham Sands is covered by an annual topographic survey extending from the South Gare Breakwater, although the survey is contiguous with the 6-monthly Redcar Sands survey. Data have been used to create a DGM (Appendix B – Map 1) using GIS. This shows that the beach contours</p>	



Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>recorded in Autumn 2020 remain shore parallel along the frontage, with a gently shelving beach slope. The beach is narrower and steeper to the north west of the subtle promontory around 1km SE of the breakwater and of shallower gradient further south-east.</p> <p>The GIS has also been used to calculate the differences between the current topographic (Autumn 2020) survey and the earlier topographic survey (Autumn 2019), as shown in Appendix B – Map 5, to identify areas of erosion and accretion.</p> <p>The topographic difference plot shows that accretion has been the dominant process over much of the survey area. The area and extent of change is similar to that recorded 12 months ago and points to a general trend of stability with some localised areas of erosion. The greatest areas of accretion are focused around the mid beach in the central swathe of the survey extent. There has been some erosion in the north west of the survey area however this has generally been constrained to the lower beach. In the south east of the survey area, in the section of beach fronting the Boating Lake and Bandstand there has been heightened levels of erosion of up to 0.75m. Overall change is limited to <math>\pm 0.75\text{m}</math> across the survey area.</p>	

## 2.2 Redcar Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p style="text-align: center;">4<sup>th</sup> November 2020</p>	<p><b>Beach Profiles:</b></p> <p>Redcar Sands is covered by three beach profile lines during the Full Measures survey (RC5 to RC7; Appendix A), with RC7 being approximately on the boundary with the Marske Sands area.</p> <p>At profile <b>1cRC5</b>, erosion has decreased the beach level at the toe of the sea defence, from chainage 17m to chainage 25m, by 0.3m. From chainage 25m to chainage 60m an upper beach berm has developed with some accretion of material increasing beach levels by 0.3m in this location. Between chainage 60m and chainage 70m the profile has remained unchanged. Seawards of this point, from chainage 70m to chainage 108m a mid-beach berm has formed increasing beach levels by up to 0.5m. From chainage 108m to 130m the profile has experienced erosion leading to a reduction in level of 0.3m. At the seaward end of the profile from chainage 130m until the end of the survey at chainage 185m the rock platform is exposed as it was in the previous Spring 2020 survey. When compared with the range recorded from previous surveys, the profile is at a medium level.</p> <p>At profile <b>1cRC6</b>, the upper beach profile has remained stable from the seawall to chainage 60m. Between chainage 60m and 65m beach levels have increased by 0.2m. Elsewhere on the upper beach from chainage 65m to 100m beach levels have dropped by 0.3m. From chainage 100m to 160m beach levels have increased by 0.1m to 0.2m whereas from chainage 160m to 250m they have decreased by the same amount. Between chainage 250m and 280m there has been no change. At the seaward end of the profile between chainage 280m and the end of the survey at chainage 305m there has been slight erosion causing a reduction in level of up to 0.2m. As a result of these changes, when compared with the range recorded from previous surveys, the November 2020 profile is generally at a high level with the exception of the upper beach where the level is low.</p> <p>Profile <b>1cRC7</b> has experienced very little change on the dune frontage since May 2020. At the toe of the dunes, between chainage 68m and 75m there is a small increase in level of 0.1m. On the upper beach from chainage 75m to 115m there has been a decrease in level of 0.2m. Whereas between chainage 115m and chainage 190m the beach level has increased by 0.2m. This alternating trend is repeated between chainage 190m and chainage 270m where levels have dropped by 0.2m. At the seaward end</p>	<p>All three of the profiles show alternating bands of erosion and accretion in autumn 2020, with more erosion being experienced on the upper beach. The magnitude of change is generally low.</p> <p>The topographic change plot between May 2020 and November 2020 broadly reflects this pattern with a mixture of accretion and erosion since the Spring survey with erosion being experienced on the upper beach. The pattern of change between Autumn 2019 and Autumn 2020 shows slightly more variability but generally similar patterns across the survey extent with the exception of the area to the west of Redcar Rocks.</p> <p><b>Longer term trends:</b> The beach levels are generally at a medium to high level compared to previous years, suggesting recovery since the storms and surge of winter 2013/14. A slight exception to this is on the upper beach in 1cRC6 and 1cRC7 where levels appear to be low when compared against the previously recorded range of results.</p> <p>The new hard defences at Redcar have affected the patterns of accretion on the upper beach due to the introduction of a less reflective seawall.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>of the profile the trend is once again reversed and the profile has increase in level by 0.2m from chainage 270m until the end of the survey at chainage 345m. Overall, the beach is at a low level on the upper beach, and a high level seawards from the upper-mid beach when compared with the range recorded from previous surveys. Between chainage 125m and chainage 158m the profile is at its highest recorded level. Similarly, on the lower beach between chainage 295m and chainage 305m the profile is at its highest recorded level.</p>	
<p><b>November 2020</b></p>	<p><b>Topographic Survey:</b></p> <p>Redcar Sands is covered by a six-monthly topographic survey. Data have been used to create a DGM (Appendix B – Map 2) using GIS. The plot shows shore-parallel contours for most of the frontage with the exception of the beach in front of Redcar, where there is a bay between the Redcar Rocks and West Scar. The most landward part of this embayment is close to Redcar Esplanade, where the beach is steeper than on any of the surrounding coast. The coastal defence scheme here was constructed between the October 2012 and March 2013 surveys.</p> <p>The GIS has also been used to calculate the differences between the current topographic survey (Autumn 2020) and the previous full measures survey (Autumn 2019) and the most recent (Spring 2020) topographic survey, as shown in Appendix B – Maps 6 and 9, to identify areas of erosion and accretion.</p> <p>Between Spring 2020 and Autumn 2020 the magnitude of change is varied but relatively small in magnitude. In the far north west of the survey extent a low level of erosion has dominated, however moving eastwards towards Redcar Rocks the pattern becomes more varied. The general trend is for a low level of accretion with some isolated patches of erosion around the rocks themselves. Erosion has been experienced along the upper beach fronting the seawall whilst the mid beach has generally remained stable. To the east of Redcar Rocks the pattern becomes more ordered with shore parallel bands of erosion and accretion experienced across the remainder of the survey area. The magnitude of change is low, with changes limited to <math>\pm 0.5\text{m}</math>.</p> <p>The pattern of change between Autumn 2019 and Autumn 2020 shows a similar pattern erosion and accretion particularly to the west of Redcar Rocks. Erosion dominates the frontage in the far north west (fronting the Pavilion at Coatham). Eastwards from this point there is a mixture of erosion and accretion with erosion tending to be concentrated on the lower and mid-beach. To the east of Redcar Rocks there</p>	

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>is an area of erosion which spans the whole beach (from upper to lower). This lies adjacent to an area of erosion, broadly fronting The Stray. The remainder of the survey extent is dominated by accretion with the exception of the upper beach around the beach access point at Marske. .Generally, the magnitude of change remains low across the 12 month comparison period with changes limited to <math>\pm 1.5\text{m}</math> with the majority of the survey extent having experienced less significant change of <math>\pm 0.75\text{m}</math> .</p>	

## 2.3 Marske Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>4<sup>th</sup> November 2020</p>	<p><b>Beach Profiles:</b></p> <p>Marske Sands is covered by two beach profile lines during the Full Measures survey (RC7 to RC8; Appendix A), with RC7 being approximately on the boundary with the Redcar Sands area.</p> <p>Profile <b>1cRC7</b> is located along The Stray and has been discussed in Section 2.2.</p> <p>At profile <b>1cRC8</b>, there is no change to the face of the cliff. The profile has generally remained stable over the summer of 2020. On the upper beach from the toe of the cliff at chainage 55m to chainage 100m there has been a slight increase in level of 0.1m. Between chainage 100m and 160m a wide shallow berm has formed, experiencing approximately 0.2m of accretion. From chainage 160m until 220m another similar berm has formed from approximately 0.2m of accretion. Seawards of this point until the end of the survey at chainage 310m there has been more significant accretion causing an increase in level of 0.6m, which has extended the seaward toe of the profile seawards by approximately 35m. The beach profile is at a medium level compared with the range of previously recorded surveys.</p>	<p>Both profiles at Marske Sands have experienced accretion associated with migrating berms. Profile 1cRC7 at The Stray has also experienced a low level of erosion and remains at a low level when compared with the range recorded in previous surveys. At Profile 1cRC8 accretion has dominated and shore parallel berms have developed across the beach.</p> <p>The difference plot for Autumn 2019 to Autumn 2020 shows a wide band of accretion on the mid-beach with erosion generally limited to the upper beach and sporadically elsewhere.</p> <p><b>Longer term trends:</b> Current beach profiles are medium compared with the range of previously recorded results. Recorded changes are due to the movement of bars on the beach, which is also shown on the topographic difference plots.</p>
<p>November 2020</p>	<p><b>Topographic Survey:</b></p> <p>Marske Sands is covered by an annual topographic survey. This survey is contiguous with the Redcar Sands and Saltburn Sands topographic surveys that are both surveyed six-monthly. Data have been used to create a DGM (Appendix B – Map 2) using GIS. The GIS has also been used to calculate the differences between the Autumn 2019 and Autumn 2020 topographic survey, as shown in Appendix B – Map 7. The topographic contours are generally shore parallel except where the outfalls of small, culverted streams issue in front of the Marske itself.</p> <p>Since the previous topographic survey in Autumn 2019, accretion and erosion has occurred in wide broadly shore parallel bands. The upper beach has experienced erosion across much of the survey extent, notably around Marske and onto Saltburn Sands (directly to the west of Hazel Grove). The mid-beach has generally experienced accretion, in some places band of accretion spans the full mid-beach and across the lower-beach. The magnitude of change remains modest at approximately <math>\pm 1.25\text{m}</math>.</p>	

## 2.4 Saltburn Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
<p>4<sup>th</sup> November 2020</p>	<p><b>Beach Profiles:</b></p> <p>Saltburn Sands is covered by one beach profile during the Full Measures survey (RC9; Appendix A).</p> <p>At profile <b>1cRC9</b>, there has been accretion of 0.2m of material at the toe of the seawall from chainage 21m to 26m. Whilst from chainage 26m to 55m beach levels have decreased by 0.4m Seaward of this point, from chainage 55m to chainage 145m beach levels have increased by 0.3m. Between chainage 140m and 180m there has been no discernible change. At the seaward end of the profile from chainage 180m until the end of the survey at chainage 235m there has been a slight increase in level of 0.1m. Overall, the beach is at a medium level compared to the range recorded from previous surveys.</p>	<p>The beach showed a general trend of stability with some slight increases in level at profile 1cRC9.</p> <p>The difference plot between the last partial measures survey in Spring 2020 and the present full measures survey in Autumn 2020 shows low levels of accretion across much of the beach. There is also some limited erosion much across the upper beach, fronting the promenade and sea wall and around the mouth of Skelton Beck. The difference plot between the last full measures survey in Autumn 2019 and the present full measures survey in Autumn 2020 shows slightly more variability trend to the west of Skelton Beck although the majority of change remains low in magnitude.</p>
<p>November 2020</p>	<p><b>Topographic Survey:</b></p> <p>Saltburn Sands is covered by a six-monthly topographic survey, although the survey is contiguous with the Marske Sands topographic survey that is surveyed annually. Data have been used to create a DGM (Appendix B – Map 3) using a GIS software package. This shows that the beach contours are shore parallel and gently shelving for the majority of the frontage. The contours are slightly indented opposite Skelton Beck, where the stream has eroded the foreshore.</p> <p>The GIS has also been used to calculate the differences over the six month period between Spring 2020 and Autumn 2020 topographic survey, as shown in Appendix B – Map 10, and the change since the last full measures survey in Autumn 2019, to identify areas of net erosion and accretion (Appendix B – Map 7).</p> <p>When comparing the difference plot from October 2019 to November 2020 the magnitude of change across Saltburn Sands is generally low. In the west of this survey extent at Hazel Grove, changes comprise of erosion on the upper beach and wide band of accretion across the mid and lower beach. Moving eastwards towards Skelton Beck the magnitude of change decreases and to the east of the Beck the change is low. There has been some erosion on the upper beach at the mouth of the Beck. Elsewhere the difference plot shows stability and some accretion. The magnitude of change over the previous twelve months is limited to <math>\pm 1.25</math>m. This is a trend is mirrored in the six month difference plot which shows the change between May 2020 and November 2020. To the west of Skelton Beck there</p>	<p><b>Longer term trends:</b> The April 2019 beach level was one of the lowest recorded profile since 2008, suggesting ongoing progressive erosion. Although beach levels appear to have generally recovered, the trend of increasing erosion through the winter months with some recovery over the summer is leading to the progressive erosion and drawdown of the beach. This pattern has been experienced for several years.</p>

Survey Date	Description of Changes Since Last Survey	Interpretation
	<p>has been some erosion on the upper beach with the remainder of the beach experiencing a low level of accretion, with the exception of an isolated pocket of erosion on the mid beach fronting Hazel Grove. At the mouth of Skelton Beck there has been some erosion associated with the natural movement of the Beck outfall across the beach. To the east of the Beck the beach has remained stable with some isolated pockets of accretion and erosion. The magnitude of change is generally lower than the twelve month difference plot with the vast majority of the beach experiencing changes of <math>\pm 0.75\text{m}</math>. The one exception to this, is inside the mouth of Skelton Beck where approximately 1.5m of erosion has been experienced.</p>	

## 2.5 Cattersty Sands

Survey Date	Description of Changes Since Last Survey	Interpretation
December 2020	<p><b>Topographic Survey:</b></p> <p>Cattersty Sands is covered by a six-monthly topographic survey.</p> <p>Data have been used to create a DGM (Appendix B – Map 4) using a GIS package. The beach is steeper to the west of the breakwater than the east, but in both areas the gradient is relatively smooth. East of the breakwater, the beach is punctuated by Kilton Beck and the harbour, so the gradient is shallower. Immediately east of the former fishtail groyne (which has since been modified to a rock breakwater arm), the stream has cut a channel, which is most deeply incised at its landward extent.</p> <p>The GIS has also been used to calculate the differences between Spring 2020 and Autumn 2020 topographic surveys and is presented as DGM (as shown in Appendix B – Map 8), to identify areas of net erosion and accretion.</p> <p>The difference plot shows a mixture of accretion and erosion. To the west of the breakwater erosion has dominated the mid and lower beach. There has been a very narrow band of accretion on the upper beach towards the breakwater. Directly to the west of the breakwater the beach has remained stable with some accretion in the lee of the structure itself. Moving eastwards erosion dominates the mid and lower beach from the mouth of Kilton Beck around the modified fishtail groyne. Directly in the mouth of the Beck on the upper beach there has been some accretion. To the east of modified groyne erosion has dominated the mid beach and the erosion appears to have extended around the rock armour structure. It is notable that despite the erosion here there is some patchy accretion on the upper beach. Further east accretion becomes the more dominant process, particularly on the upper and mid-beach. In the far east of the survey extent there has been very little change. The magnitude of change is generally low, with most changes limited to <math>\pm 0.75\text{m}</math> however the mid-beach around the rock structures appears to have experienced more significant erosion of up to 1.25m.</p>	<p>The topographic change data shows Cattersty Sands is very dynamic, influenced by coastal and fluvial processes, along with the breakwater and the shorter rock armour groyne. Short term change, over the preceding six-monthly shows similar beach behaviour either side of the breakwater with accretion being the dominant process.</p> <p><b>Longer term trends:</b> The magnitude of changes experienced over the summer of 2020 has generally been similar to previous years. There has been accretion in the mouth of the Beck. Erosion around the modified rock structures should be monitored to establish if this is a trend. It is worth noting that the topographical survey in the Full Measures 2020 was actually undertaken in December which is slightly later in the year than would typically be expected. This difference plot may be picking up changes which have occurred during poor Autumn/Winter weather conditions.</p> <p>The winter erosion dominates the overall behaviour of the beach but the calmer weather in the summer months should lead to some accretion. If the erosion of the upper beach continues, it is likely to drive cliff failures, which would add material to the upper beach for redistribution.</p>



## 2.6 Staithes

Survey Date	Description of Changes Since Last Survey	Interpretation
<p><b>November 2020</b></p>	<p><b>Cliff-top Survey:</b></p> <p>Twenty ground control points have been established at Cowbar and Staithes for biannual cliff top monitoring. Locations 12 to 20 are in the Scarborough Borough Council area. The separation between any two points is around 100m. Data collection involves a distance offset measurement from the ground control point to the cliff edge along a fixed bearing.</p> <p>Between March 2020 and November 2020, 9 of the 20 ground control points experienced retreat of over 0.1m. Of these 9, a total of 4 points, 6, 9, 13, 16 and 20, experienced between 0.1m and 0.2m of erosion (0.18m, 0.13m, 0.18m, 0.16m and 0.11m respectively). One point (point 18) experienced between 0.2m and 0.3m of erosion (0.22m). Two points (point 1 and point 17) experienced between 0.3m and 0.4m of erosion (0.31m and 0.38m respectively). Only 1 point (point 10) experienced significant retreat of 1.11m.</p> <p>Points 5, 12 and 19 appeared to show advancements of 0.13m, 0.27m and 0.30m respectively. This is caused by slumping on the upper cliff face (points 5 and 19) and due to vegetation cover (point 12) inhibiting a clear measurement to the cliff edge.</p> <p>It is particularly notable that point 10 has experienced 1.11m of retreat, as this brings the present measurement at this point back to within 0.1m of the original baseline (November 2008) survey. This follows readings which indicated that the point was advancing. Points 9 to 12 were in fact not measurable between autumn 2016 and spring 2020 due to restricted access onto Cowbar Nab due to activity in the cliff units.</p> <p>Calculation of longer-term erosion rates based on the recorded change between 2008 and 2020 indicates that 17 of the 20 posts on the frontage recorded a change rate within a range of <math>\pm 0.1</math>m/year.</p> <p>Points 1, 4, and 13 (near the eastern breakwater) show average erosion rate of above 0.1m/yr.; 0.59m, 0.18m and 0.24m respectively. Appendix C provides results from the November 2020 survey, showing the distance from the ground control point to the edge of the cliff top along the defined bearing and changes in position since the November 2008 baseline survey.</p>	<p>Nine stations showed erosion of between 0.1 and 1.1m over the summer of 2020. Four stations which prior to spring 2020 had been inaccessible for several years were surveyed again.</p> <p><b>Longer term trends:</b> Table C1 shows that survey location 1 has shown the greatest total erosion with a loss of 7.11m (<math>\pm 0.3</math>m) between the November 2008 baseline and November 2020, resulting in a long-term average recession rate of 0.59m/yr.</p> <p>Location 4 has also showed progressive erosion with an average recession rate of 0.18m/year. Both of these stations are located adjacent the old Cowbar Lane which in places has now collapsed entirely.</p> <p>Location 13 has also experienced ongoing erosion of with an average recession rate of 0.24m/year. This area is above the eastern breakwater and is known to have experienced rock falls previously. The coastal path is now at risk of being undermined at this point.</p>



### **3. Problems Encountered and Uncertainty in Analysis**

#### **Cliff Top Surveys**

The cliff top surveys at Staithes are assumed to have a limit of accuracy of  $\pm 0.1\text{m}$  due to the techniques used. Posts 9 to 12 were still inaccessible due to a landslip on the headland; the area was fenced off by the National Trust. Additionally, ongoing successive cliff falls at Post 1 mean that the cliff top has now encroached into the track.

At Cattersty Sands, an area of cliff face which had collapsed prior to the 2018 Full Measures survey appears to have stabilised.

### **4. Recommendations for 'Fine-tuning' the Monitoring Programme**

There are no current recommendations for 'fine-tuning' the monitoring programme.

### **5. Conclusions and Areas of Concern**

- At Coatham Sands, there has been accretion across all profiles with some erosion experienced towards the south. Beach levels remain high compared to the range recorded from previous surveys.
- At Redcar Sands there has been a mixture of erosion and accretion typically in alternating shore parallel bands. The area around Redcar Rocks continues to experience erosion. Overall, the profile is at a medium level in the west and far south east and lower across the central swathe compared to the range recorded from previous surveys.
- At Marske Sands, the 2020 beach profiles show the beach is generally accreting with some erosion on the upper beach at profile 1cRC7. At profile 1cRC8 there is evidence of migrating beach berms. The short term topographic change plot reflects this with evidence of the migration of beach berms. The magnitude of change is low when compared with the range recorded in previous surveys.
- The beach at Saltburn Sands has remained relatively stable over the summer of 2020 with some accretion evident at profile 1cRC9. However, the trend of winter erosion and summer recovery appears to be leading to a net loss from the beach as summer recovery is not compensating fully for the winter drawdown.
- The Cattersty Sands difference model shows that erosion was the most dominant process between the Spring 2020 and Autumn 2020 surveys. Erosion dominated the mid and lower beach west of the breakwater and around the modified rock structures to the east of Kilton Beck. Some patchy accretion was recorded, particularly on the upper beach west of the breakwater. In the far east of the survey extent at the base of the cliffs the beach remained stable. Generally, the changes recorded were of a similar magnitude to that recorded in previous years, however the large area of erosion around the modified rock structures should be monitored carefully to establish if this is a developing trend.
- The measurements of the Cowbar and Staithes cliff top show erosion of between 0.1 and 1.1m over the summer of 2020 at nine stations. The largest amount of erosion occurred at Post 10 (1.1m) as a result of ongoing cliff failure. Stations 6, 9, 13, 16 and 20 experienced erosion of between 0.1m and 0.2m, whilst Station 1, 17 and 18- experienced erosion of between 0.2m and 0.4m. Station 1 is an area of longstanding concern, and the erosion recorded in 2020 is in keeping with the general trend of retreat. Station 9 to 12 were surveyed in Spring and Autumn 2020, having not been surveyed since Autumn 2016 when access to Cowbar Nab was prohibited due to a small cliff collapse. The high level of retreat recorded at Station 10 in Autumn 2020 is likely to be attributed to an anomalous reading in the spring when this Station was reported to have advanced. However, given the previous activity along Cowbar Nab this area should be monitored for further cliff failures and addressed in the next Partial Measures Survey Report. The long term trends indicate that it is only Stations 1, 4 and 13 which are experiencing a sustained average recession rate of over 0.1m/yr. This frontage is the subject of the ongoing

Staithes Strategic Appraisal Report (StAR) which seeks to address issues relating to coastal erosion.

## **Appendices**

**Appendix A**  
**Beach Profiles**

The following sediment feature codes are used on some profile plots:

<b>Code</b>	<b>Description</b>
S	Sand
M	Mud
G	Gravel
GS	Gravel & Sand
MS	Mud & Sand
B	Boulders
R	Rock
SD	Sea Defence
SM	Saltmarsh
W	Water Body
GM	Gravel & Mud
GR	Grass
D	Dune (non-vegetated)
DV	Dune (vegetated)
F	Forested
X	Mixture
FB	Obstruction
CT	Cliff Top
CE	Cliff Edge
CF	Cliff Face
SH	Shell
ZZ	Unknown

# Beach Profile

Location: 1cRC1

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

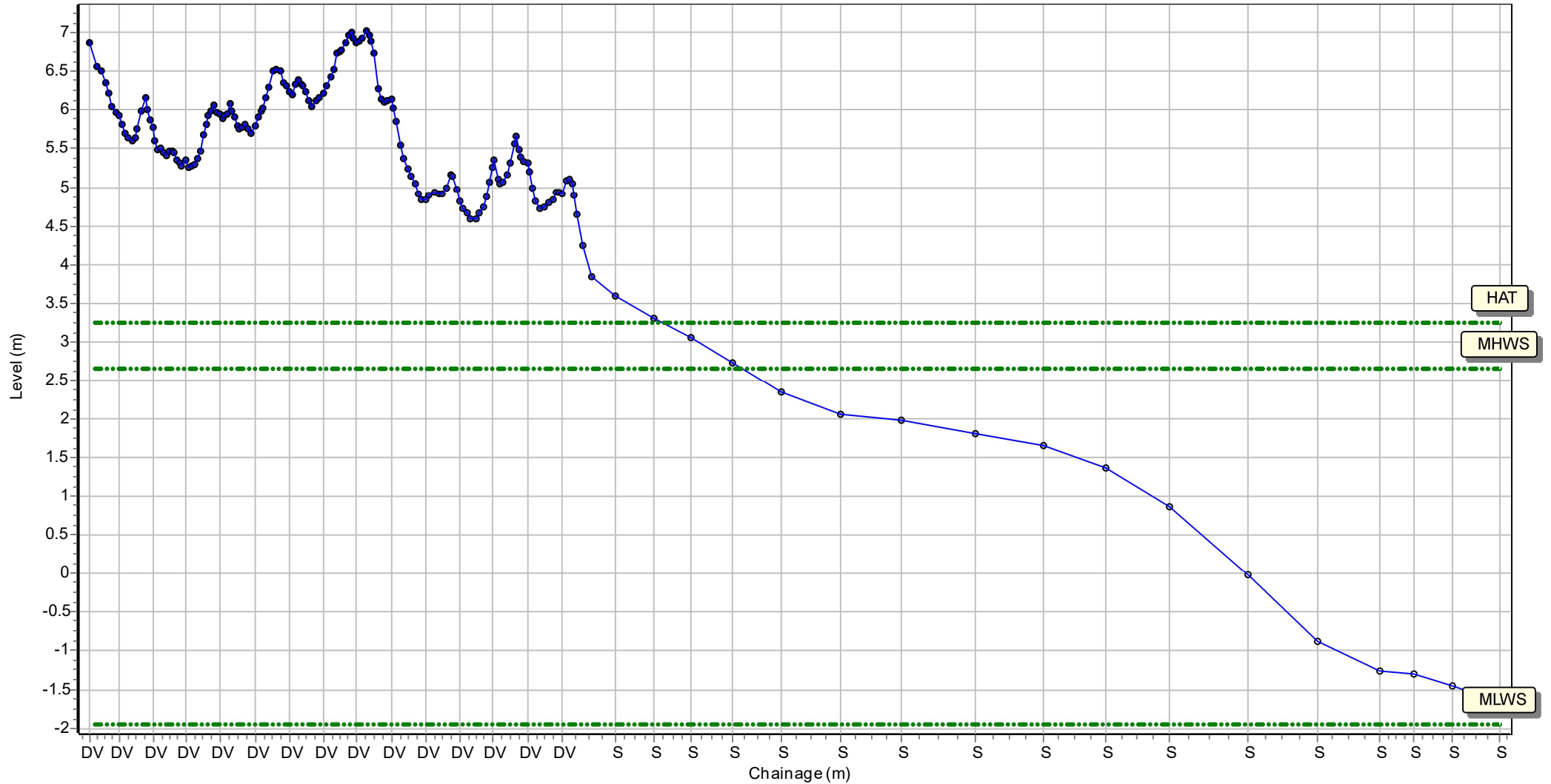
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 455811.436 Northing: 527373.402 Profile Bearing: 34 ° from North





# Beach Profile

Location: 1cRC2

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

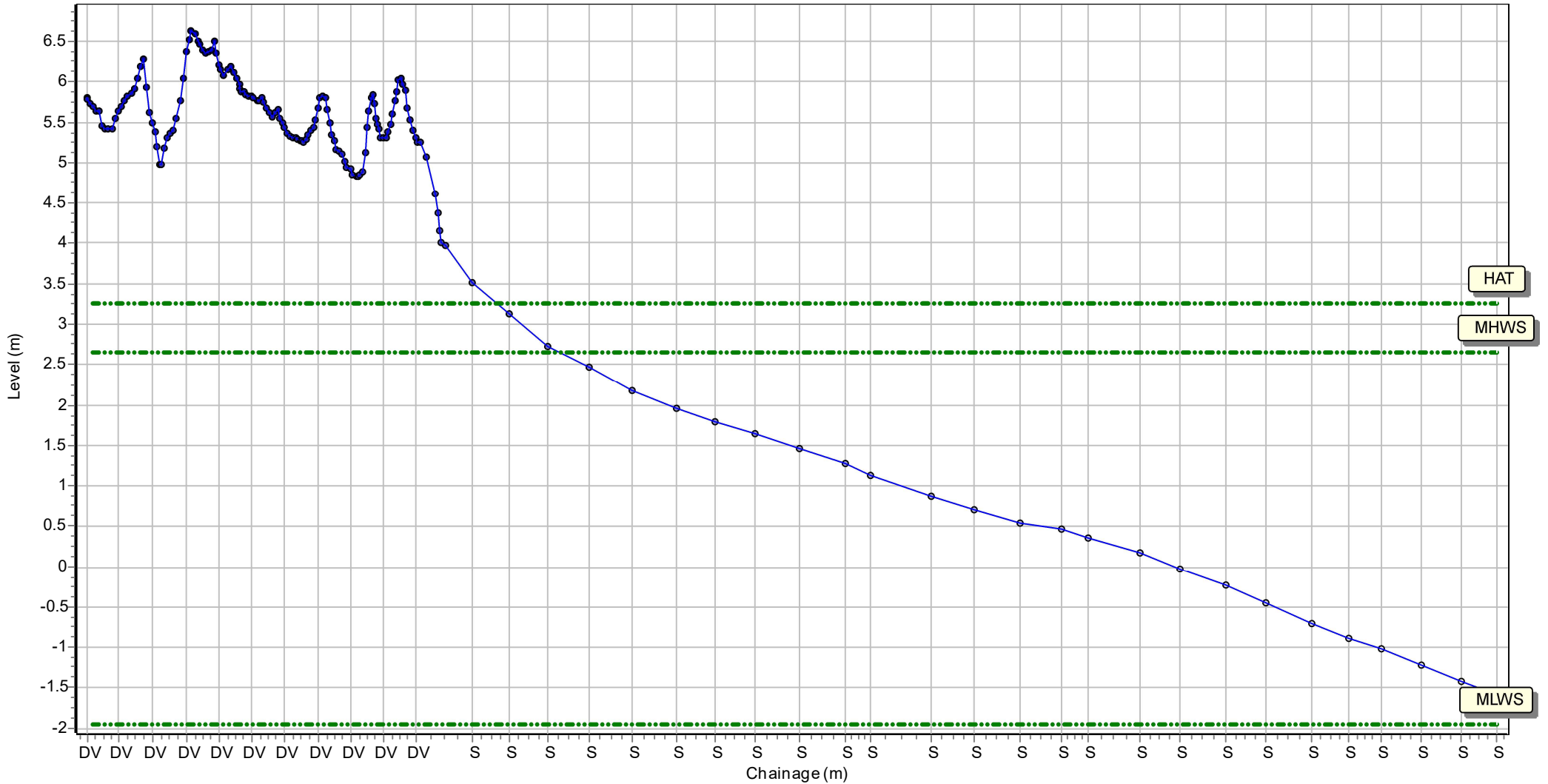
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 456633.253 Northing: 526599.577 Profile Bearing: 34 ° from North



# Beach Profile

Location: 1cRC3

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

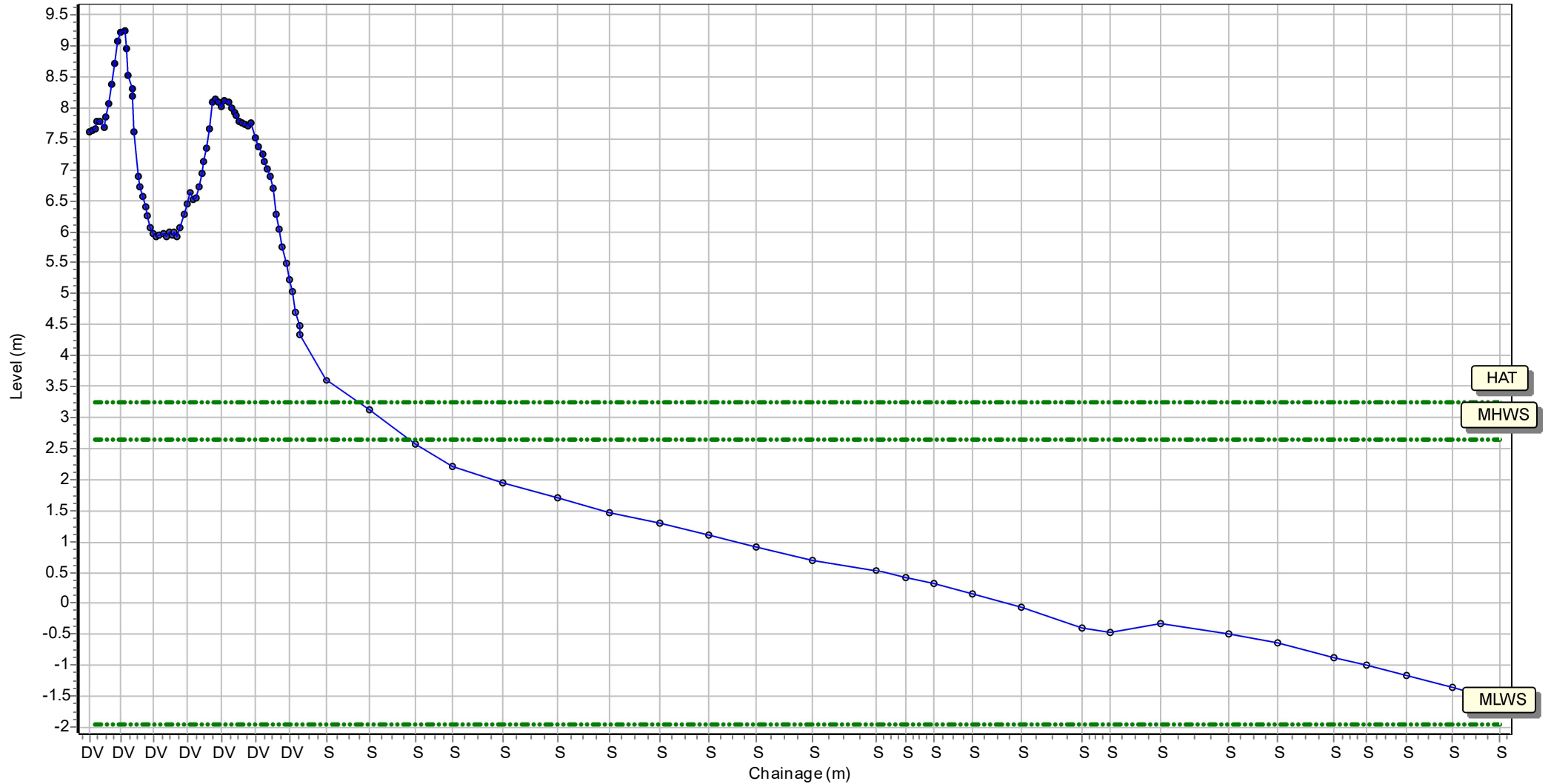
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 457706.365 Northing: 525898.597 Profile Bearing: 28 ° from North



# Beach Profile

Location: 1cRC4

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

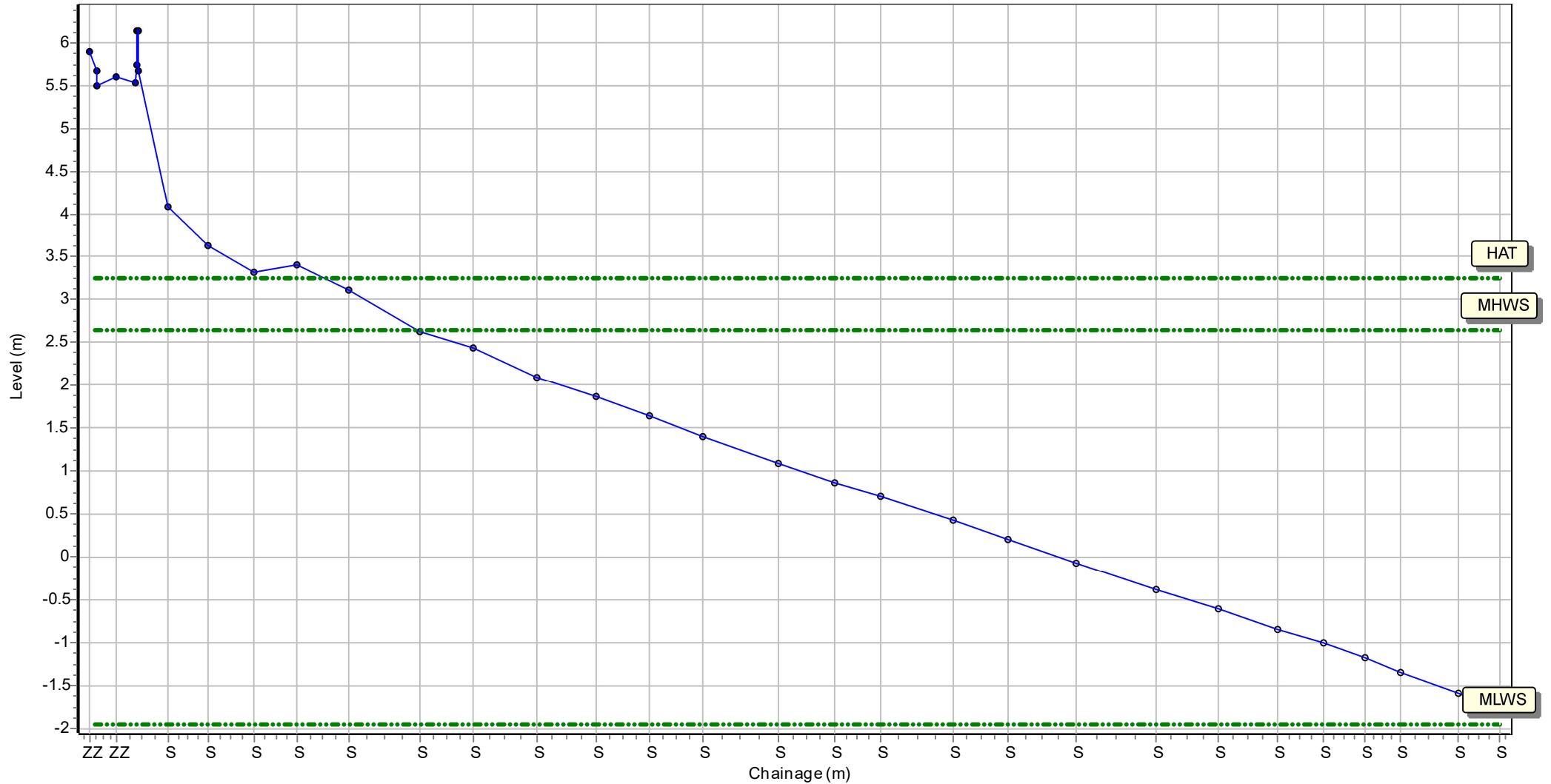
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 459337.597 Northing: 525336.99 Profile Bearing: 13 ° from North



# Beach Profile

Location: 1cRC5

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

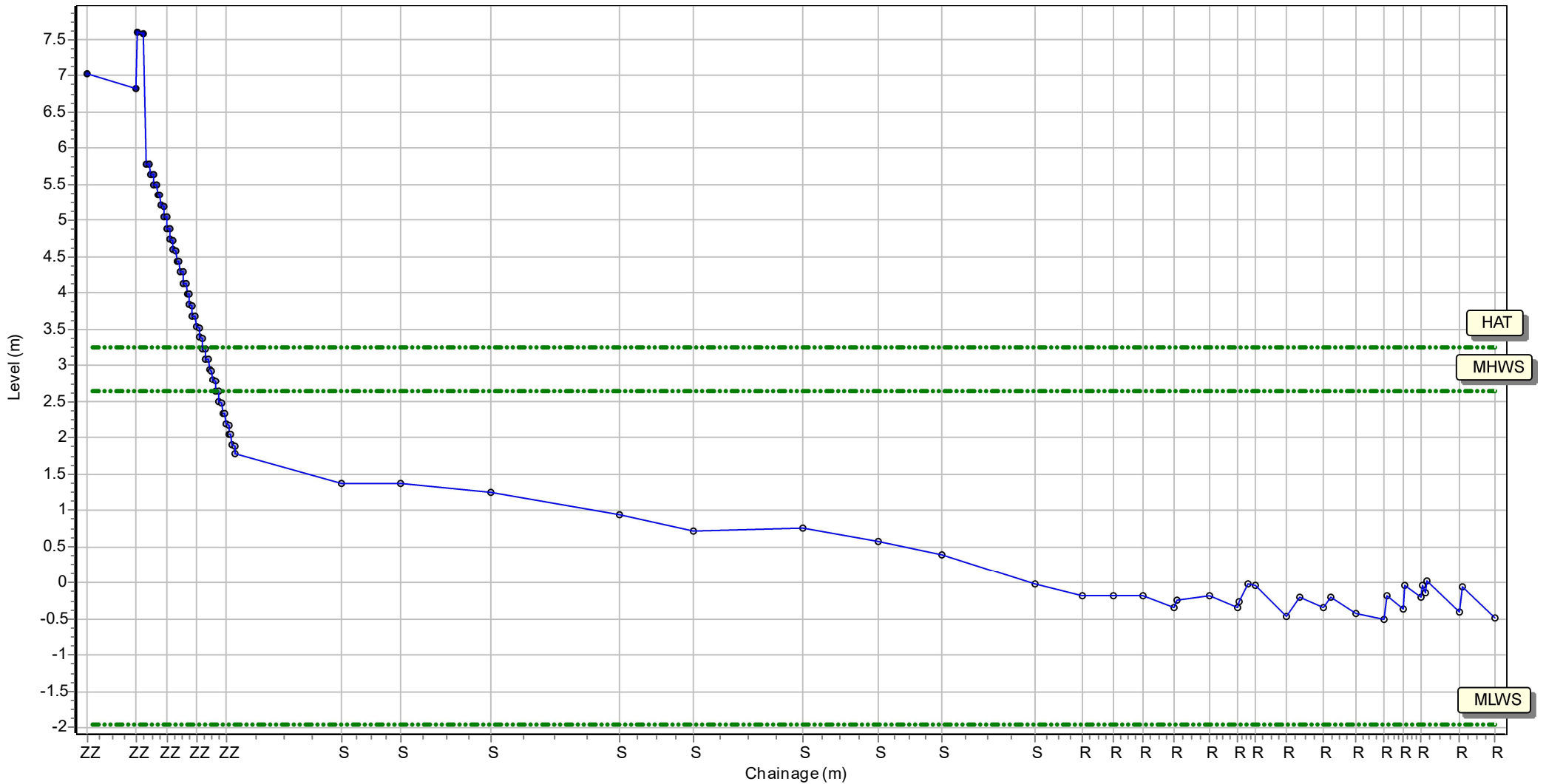
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 460845.21 Northing: 525146.997 Profile Bearing: 26 ° from North



# Beach Profile

Location: 1cRC6

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

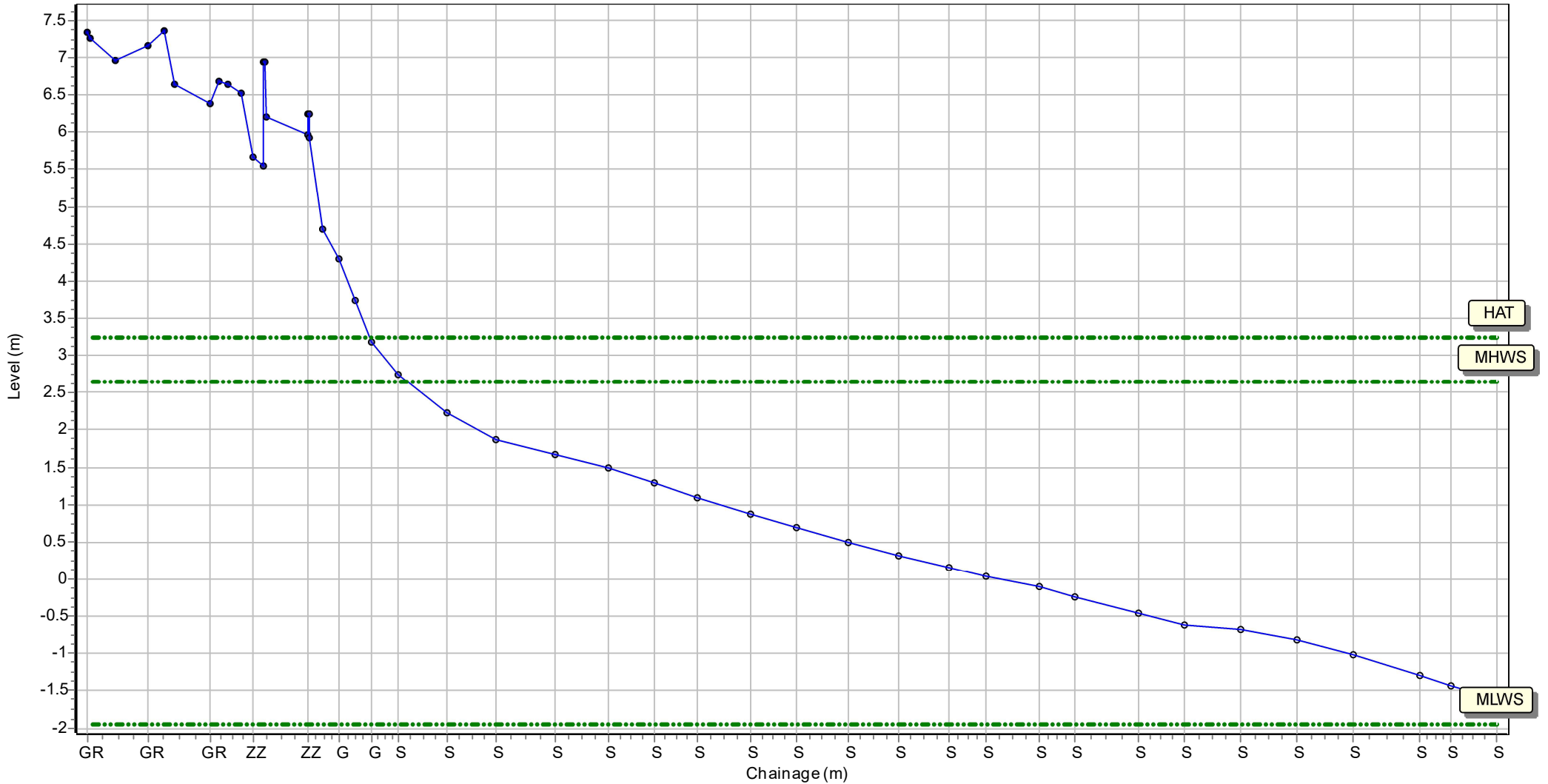
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 461776.835 Northing: 524269.592 Profile Bearing: 39 ° from North



# Beach Profile

Location: 1cRC7

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

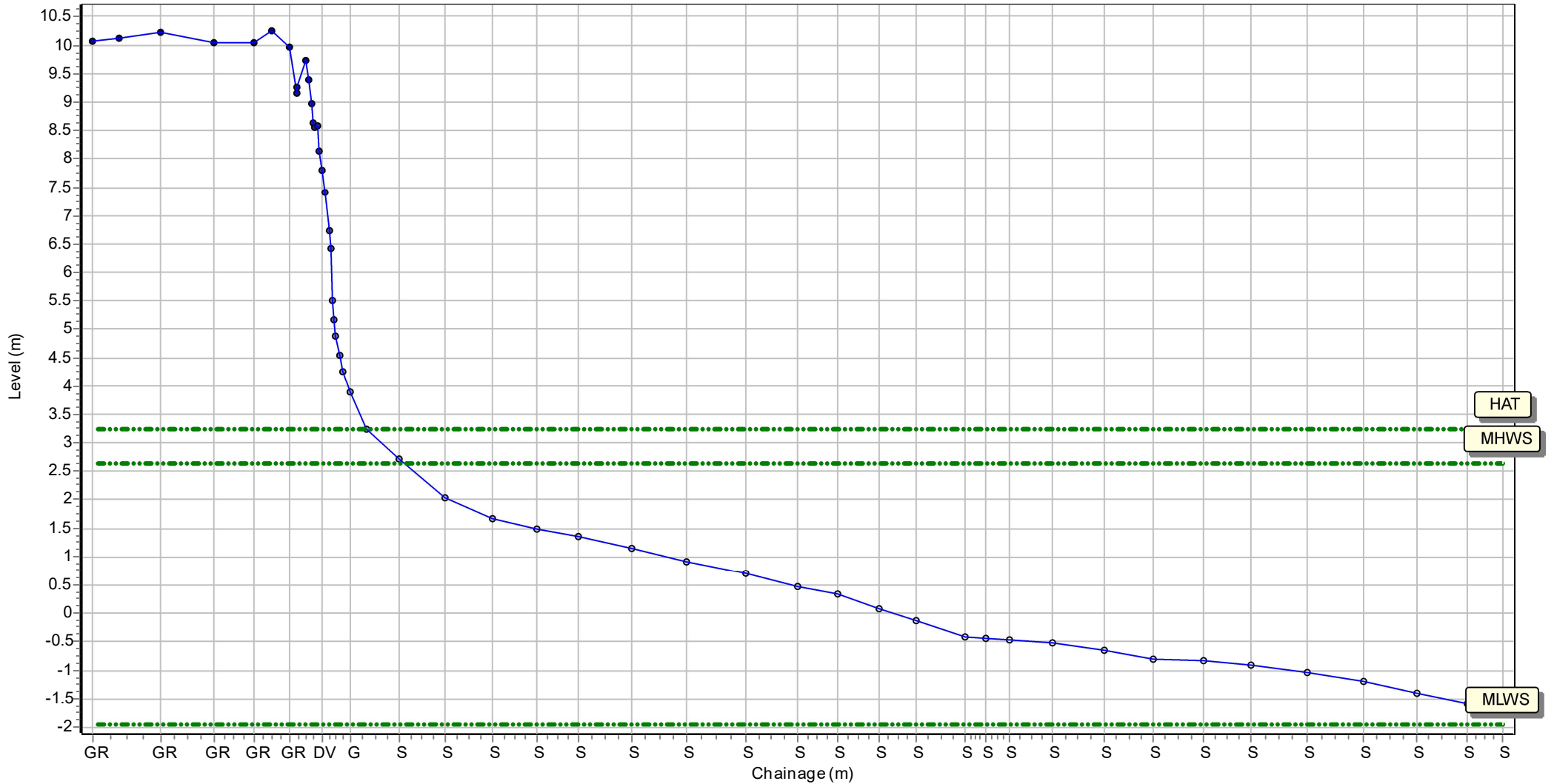
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 462568.453 Northing: 523568.436 Profile Bearing: 37 ° from North



# Beach Profile

Location: 1cRC8

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

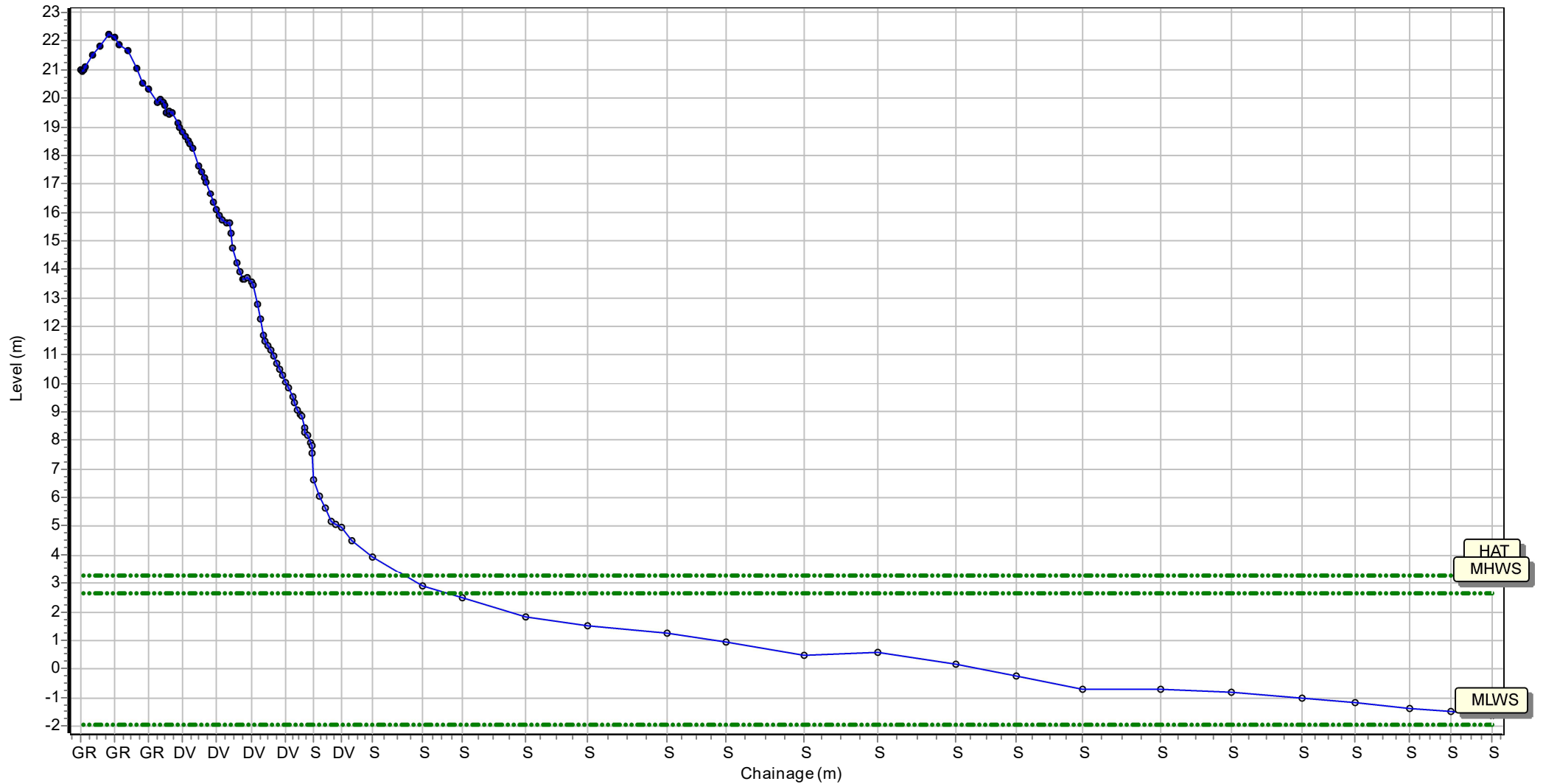
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 464245.579 Northing: 522578.097 Profile Bearing: 28 ° from North



# Beach Profile

Location: 1cRC9

Date: 04/11/2020

Inspector: AG

Low Tide:

Low Tide Time:

Wind

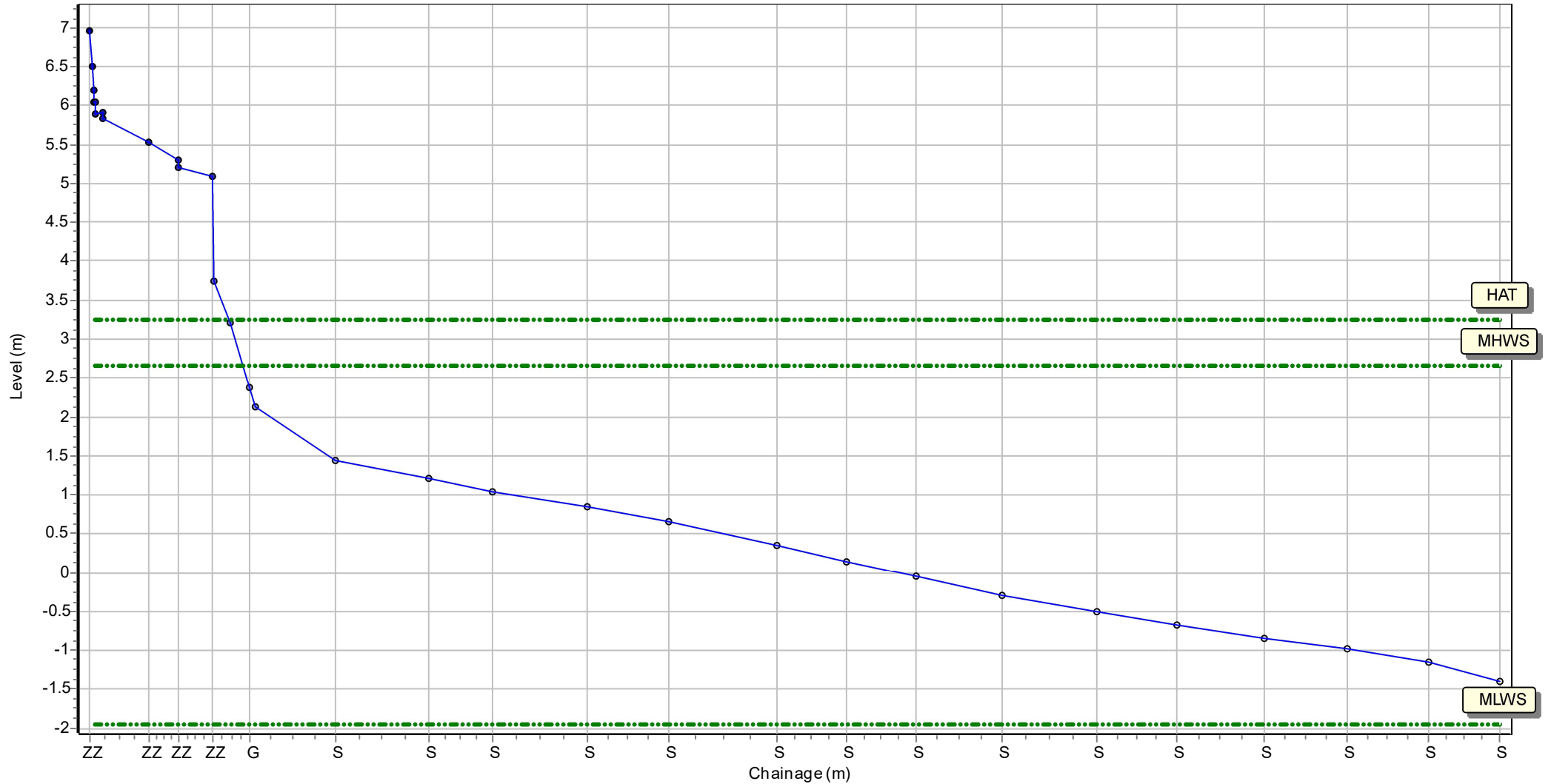
Sea State:

Visibility:

Rain:

Summary: 2020 Full Measures Topo Survey

Easting: 466477.532 Northing: 521748.87 Profile Bearing: 22 ° from North





Beach Profiles: 1cRC1



Profiles Envelope 17/11/2008 31/10/2019 29/05/2020 04/11/2020

HAT

MHWS

MLWS

SANDS

Beach Profiles: 1cRC2



HAT

MHWs

MLWS

SANDS

Beach Profiles: 1cRC3

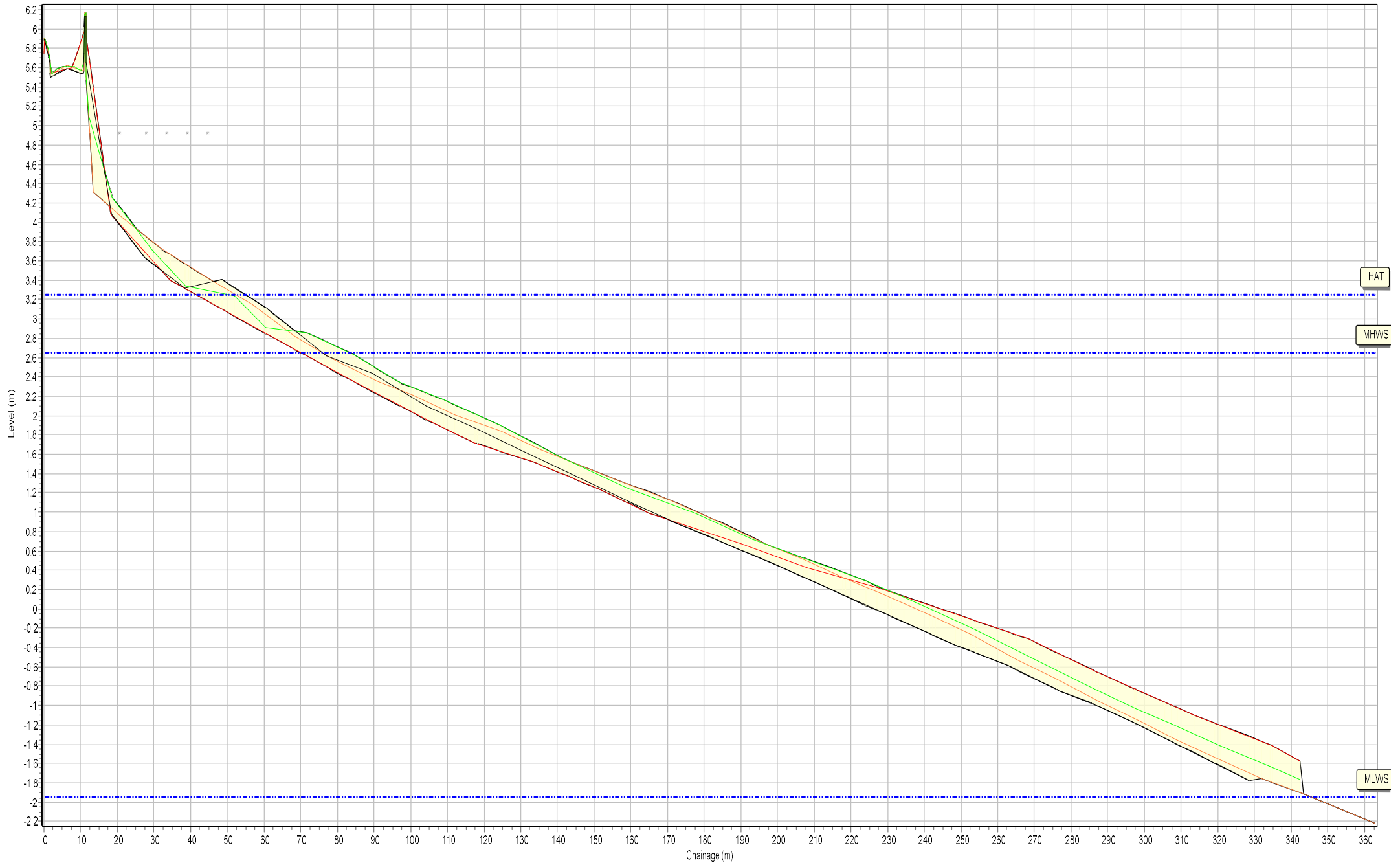


HAT

MLWS

SANDS

Beach Profiles: 1cRC4



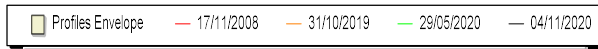
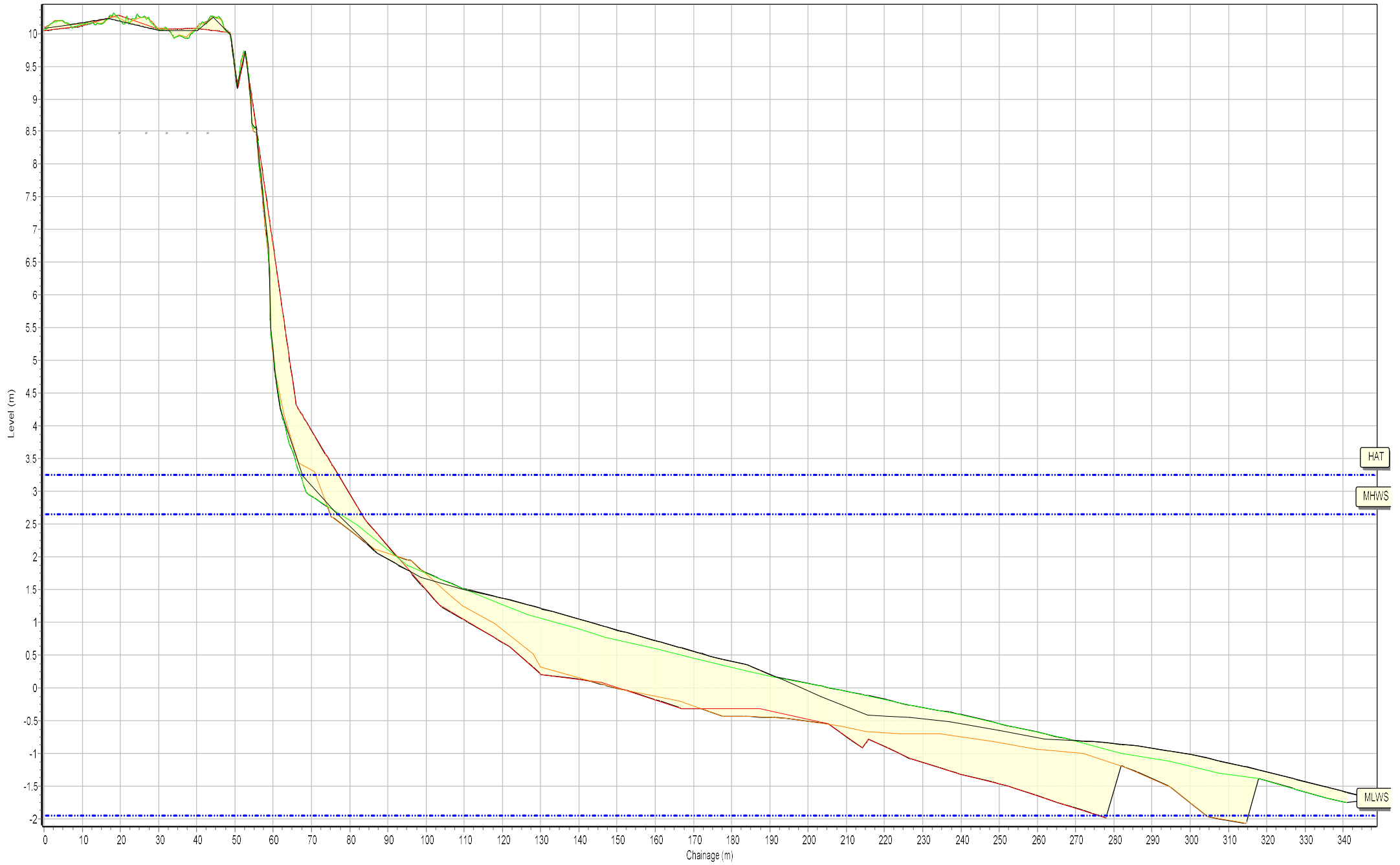
Beach Profiles: 1cRC5



# Beach Profiles: 1cRC6



# Beach Profiles: 1cRC7



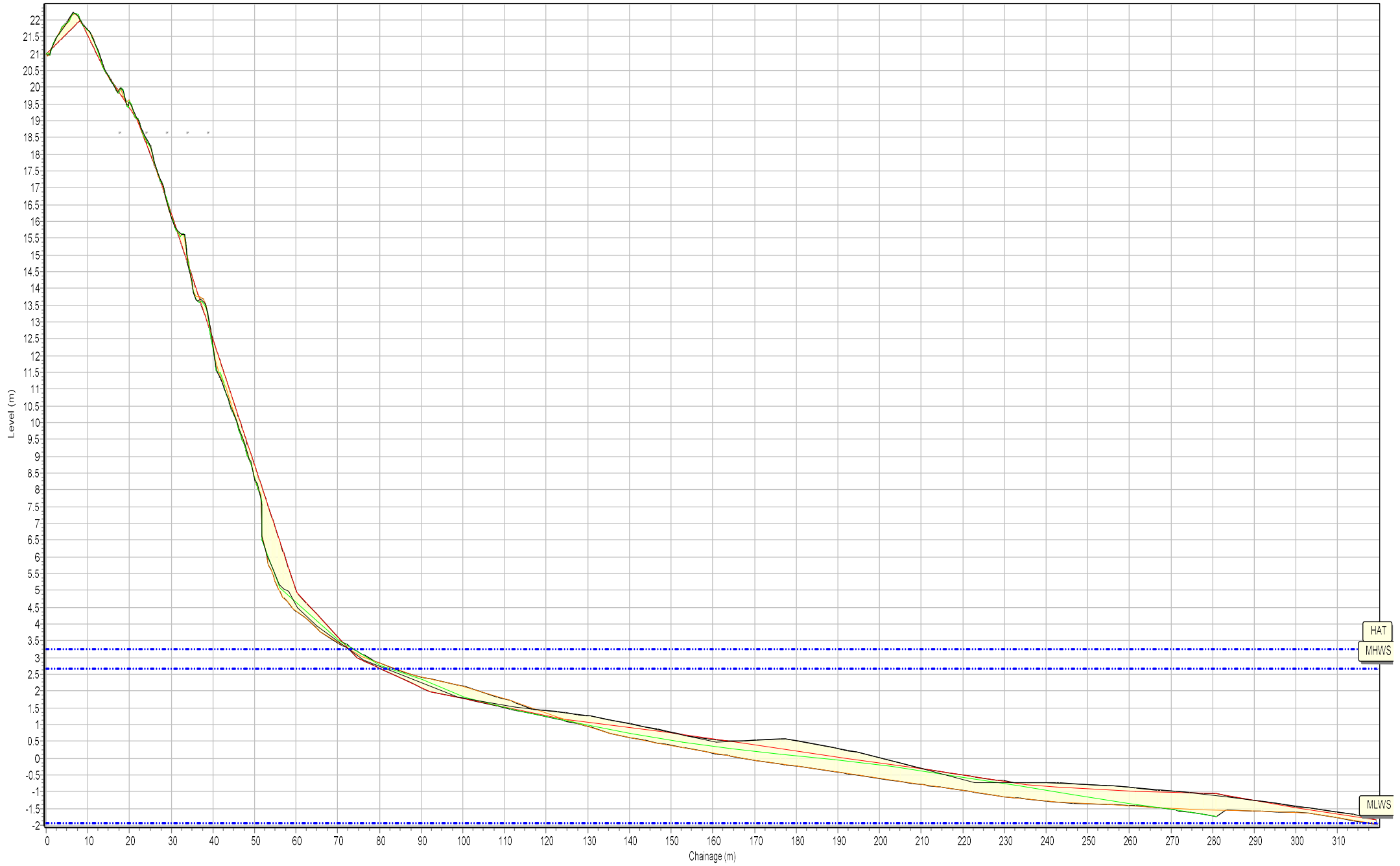
HAT

MHWs

MLWS

SANDS

# Beach Profiles: 1cRC8



HAT  
MHWs

MLWS

SANDS

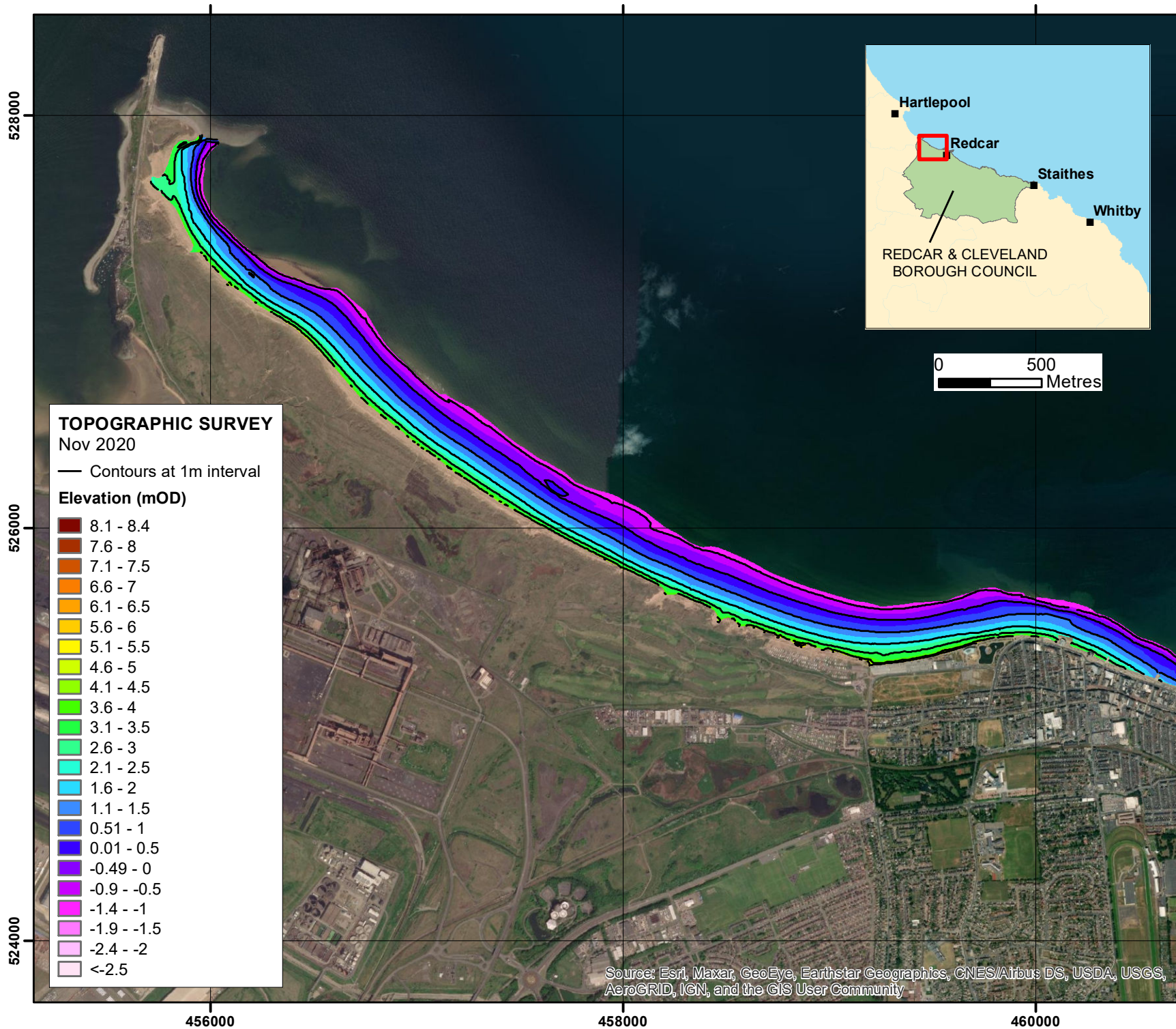


Beach Profiles: 1cRC9



Profiles Envelope 17/11/2008 31/10/2019 29/05/2020 04/11/2020

**Appendix B**  
**Topographic Survey**



Key



Client: North East Coastal Group  
Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 1**  
**COATHAM SANDS**  
**Redcar and Cleveland Borough Council Frontage**

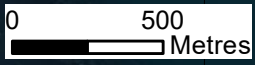
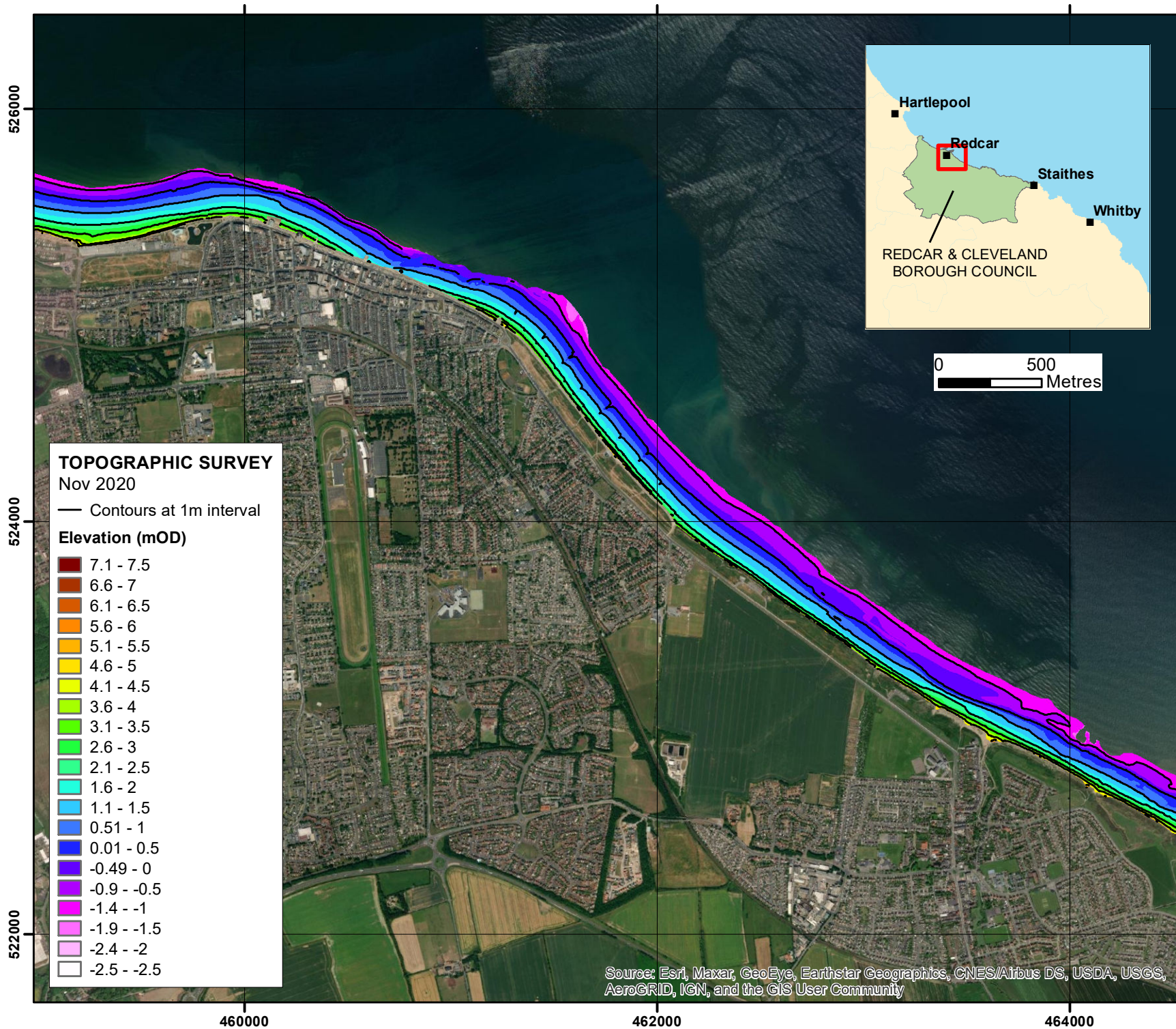
Analytical Report  
'Full Measures' Survey 2020

Drawing Scale at A4 1:25,000

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Key

Client: North East Coastal Group  
Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 2**  
**REDCAR/MARSKE SANDS**  
**Redcar and Cleveland Borough Council Frontage**  
Analytical Report  
'Full Measures' Survey 2020

Drawing Scale at A4 1:25,000

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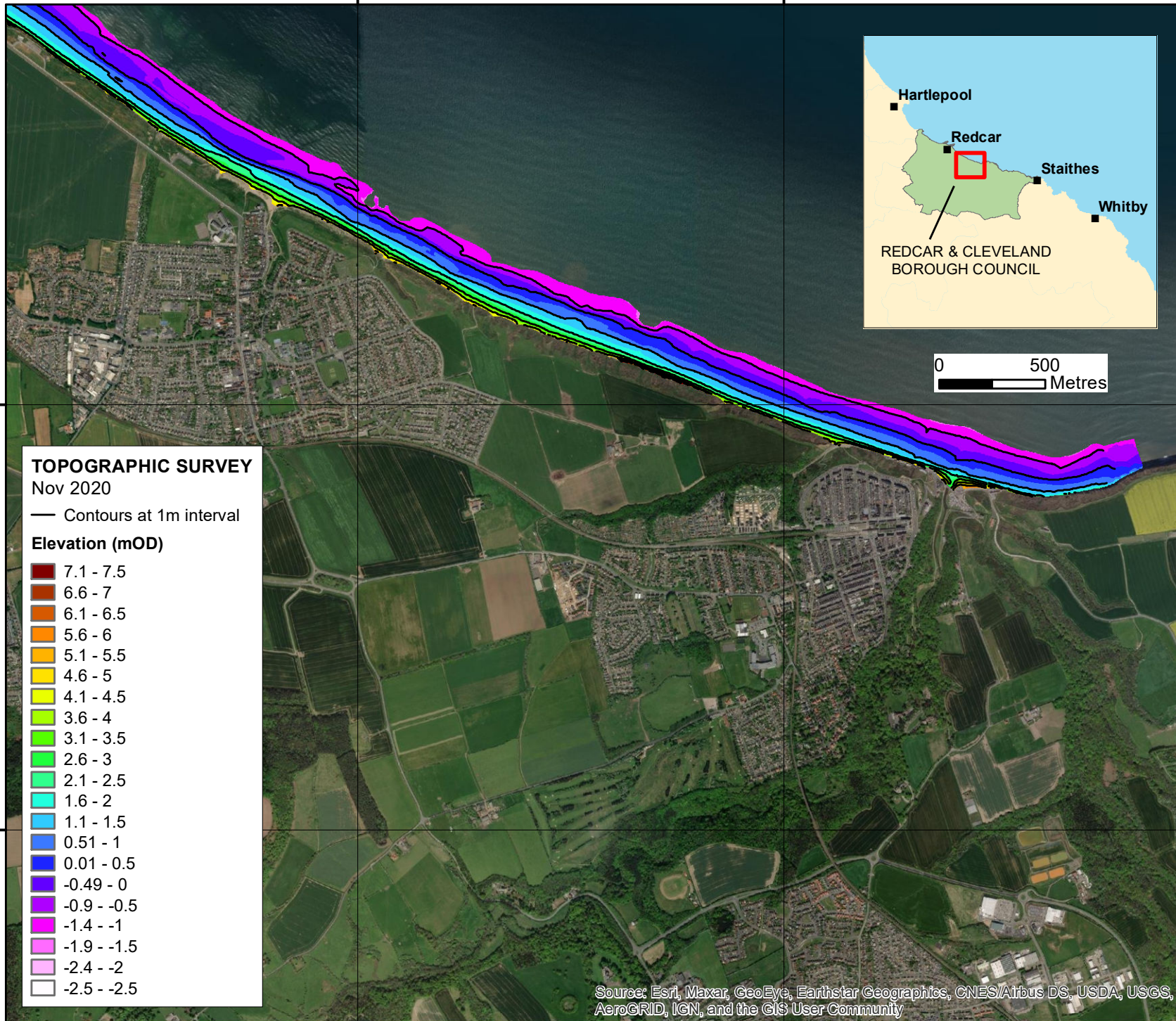


522000

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464000

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**TOPOGRAPHIC SURVEY**

Nov 2020

— Contours at 1m interval

**Elevation (mOD)**

- 7.1 - 7.5
- 6.6 - 7
- 6.1 - 6.5
- 5.6 - 6
- 5.1 - 5.5
- 4.6 - 5
- 4.1 - 4.5
- 3.6 - 4
- 3.1 - 3.5
- 2.6 - 3
- 2.1 - 2.5
- 1.6 - 2
- 1.1 - 1.5
- 0.51 - 1
- 0.01 - 0.5
- 0.49 - 0
- 0.9 - -0.5
- 1.4 - -1
- 1.9 - -1.5
- 2.4 - -2
- 2.5 - -2.5

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Key

Client: North East Coastal Group

Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 3**

**MARSKE/  
SALTBURN SANDS**

**Redcar and Cleveland  
Borough Council Frontage**

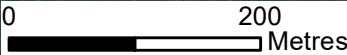
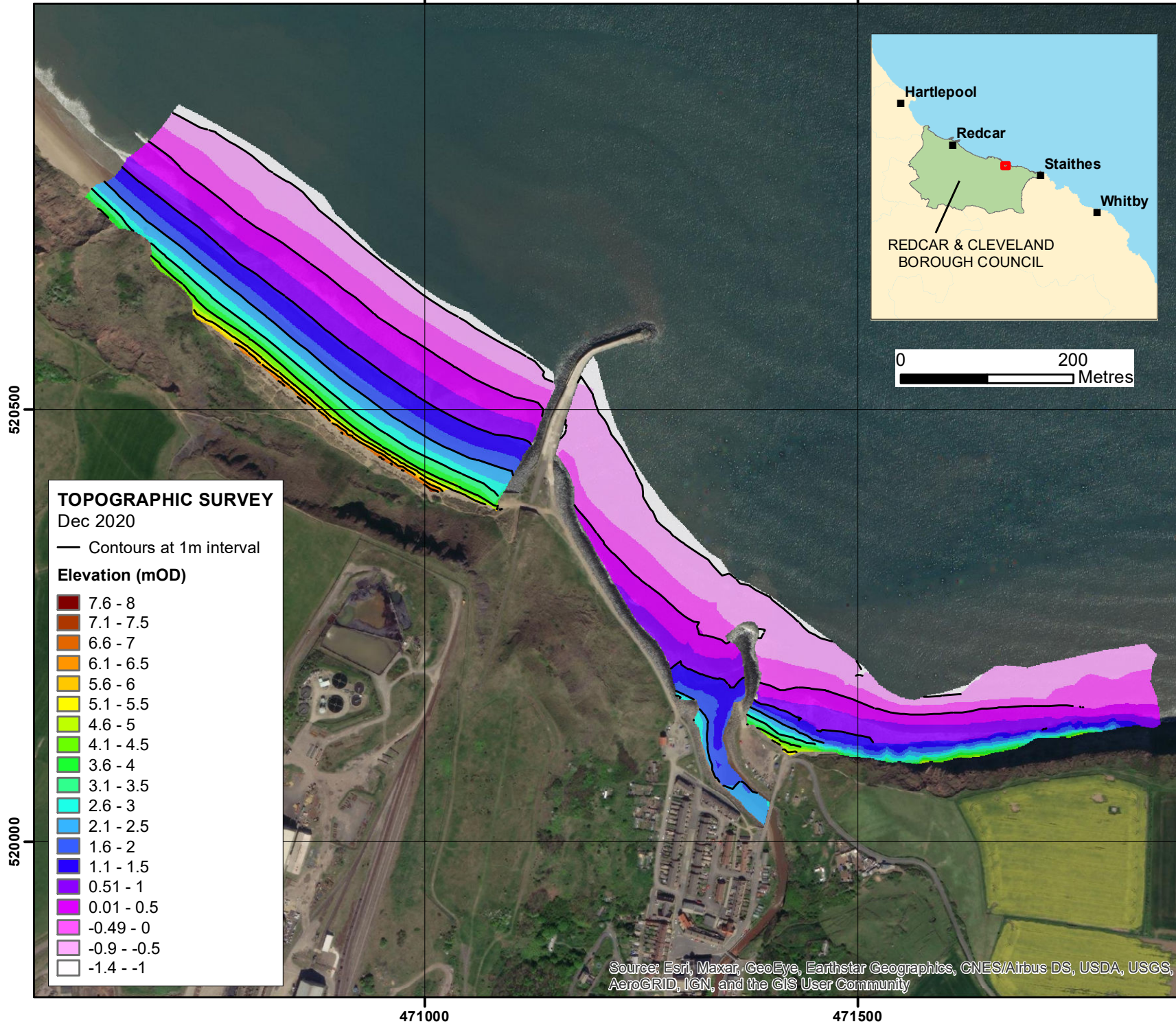
Analytical Report  
'Full Measures' Survey 2020

Drawing Scale at A4 1:25,000

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Key

Client: North East Coastal Group  
Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 4**  
**CATTERSTY SANDS**  
**Redcar and Cleveland Borough Council Frontage**

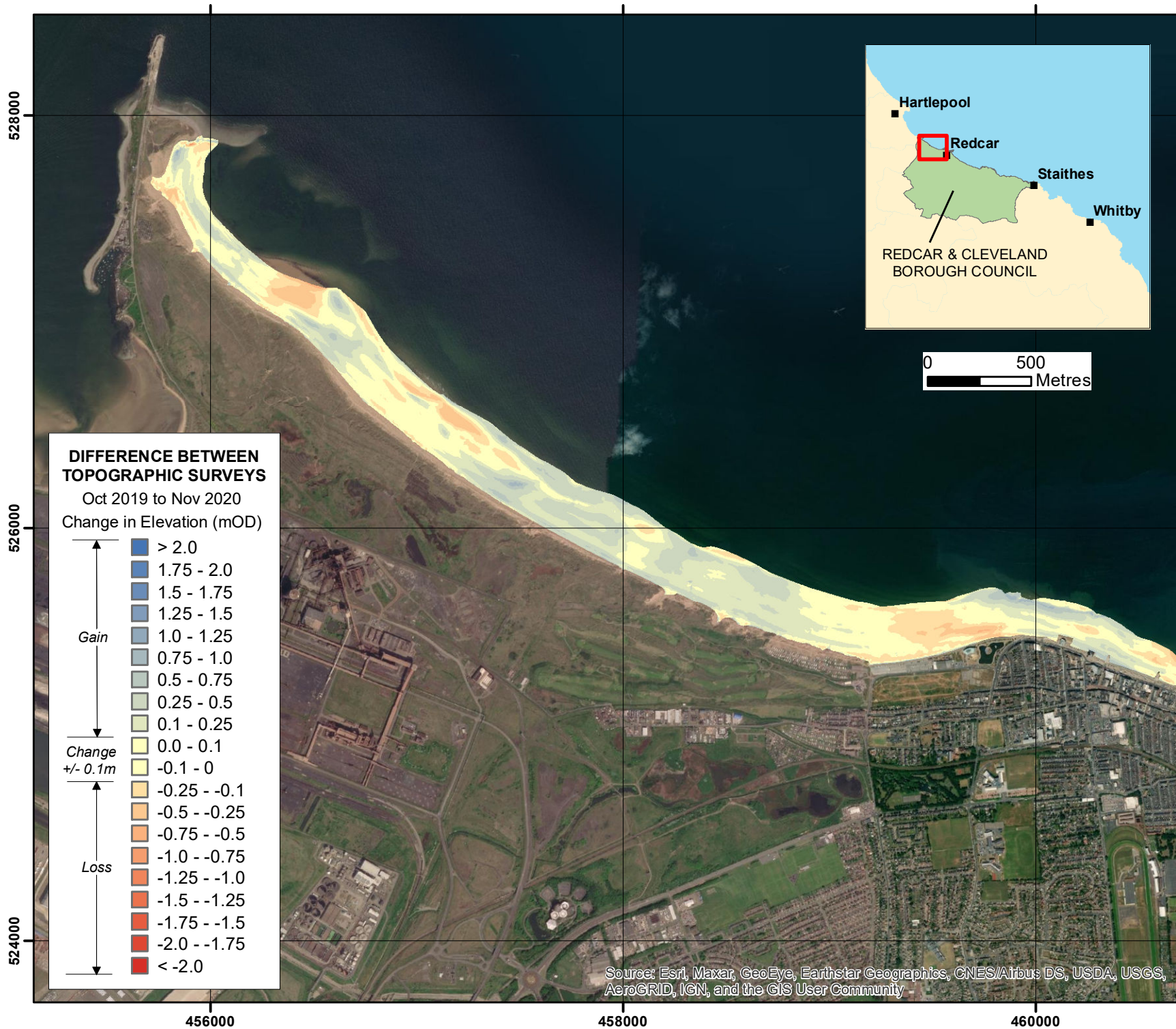
Analytical Report  
'Full Measures' Survey 2020

Drawing Scale at A4 1:6,000

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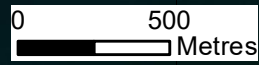
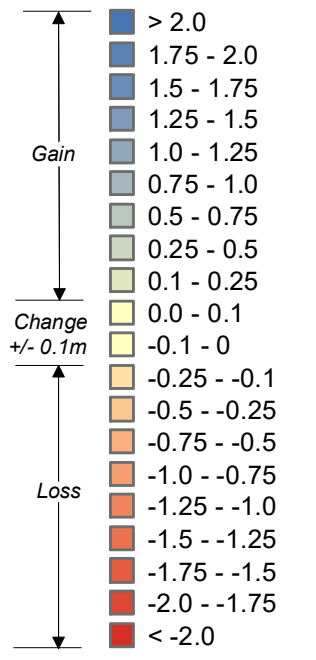
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**DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS**

Oct 2019 to Nov 2020  
Change in Elevation (mOD)



Key

Client: North East Coastal Group  
Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 5**  
**COATHAM SANDS**  
**Redcar and Cleveland Borough Council Frontage**

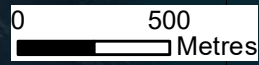
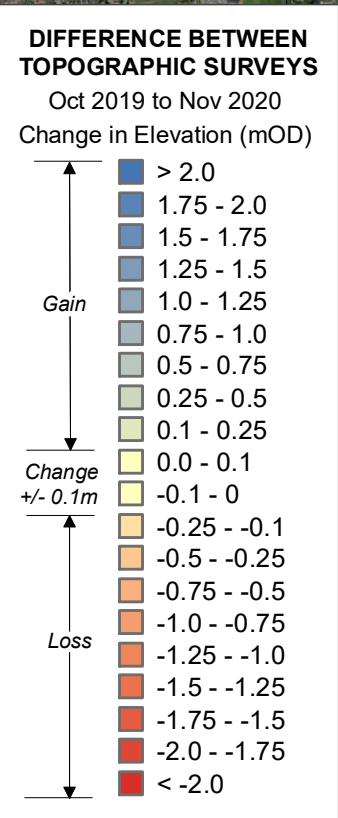
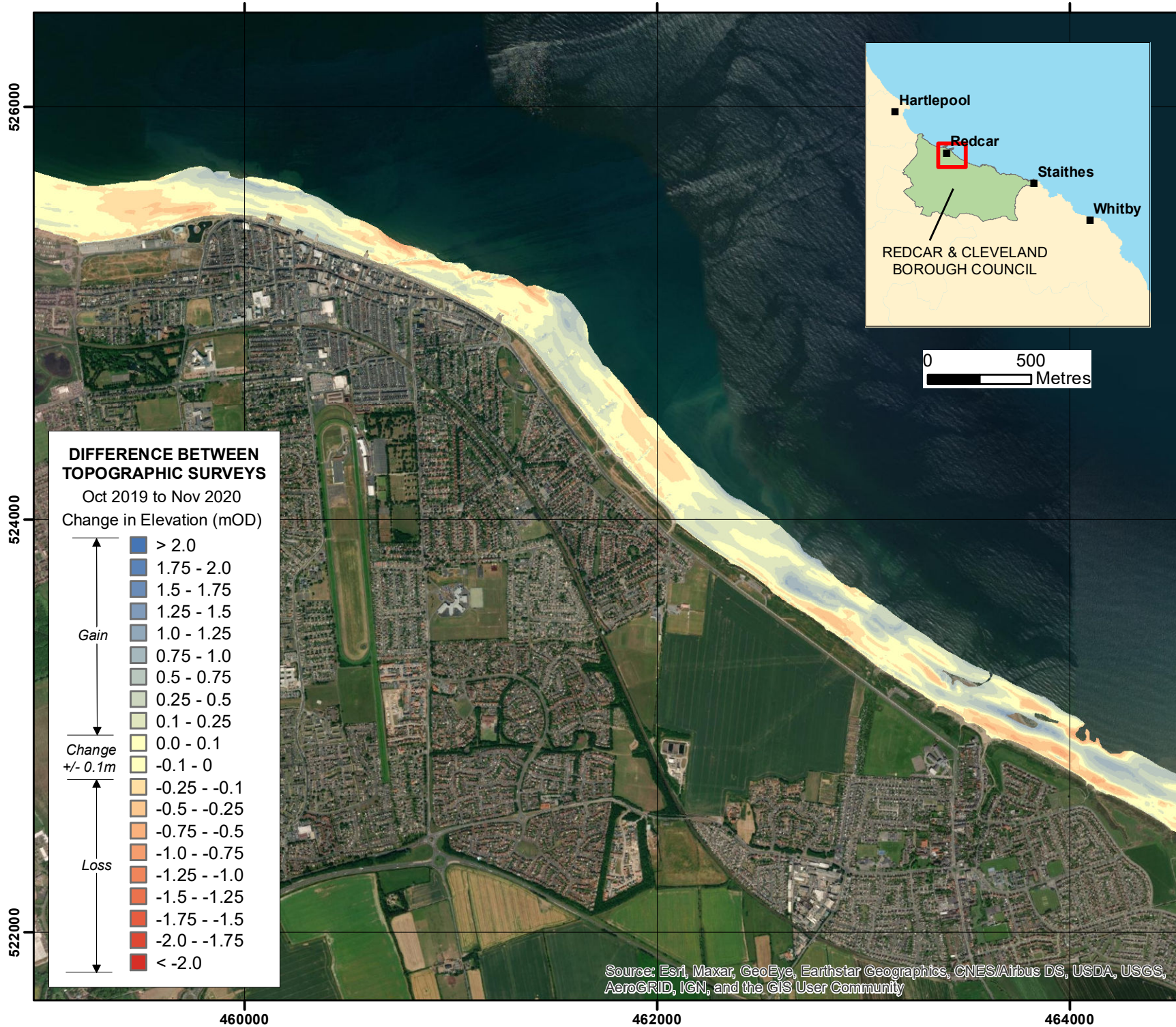
Analytical Report  
'Full Measures' Survey 2020

Drawing Scale at A4 1:25,000

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Key

Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 6**  
**REDCAR/MARSKE SANDS**

**Redcar and Cleveland Borough Council Frontage**

Analytical Report  
 'Full Measures' Survey 2020

Drawing Scale at A4 1:25,000

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

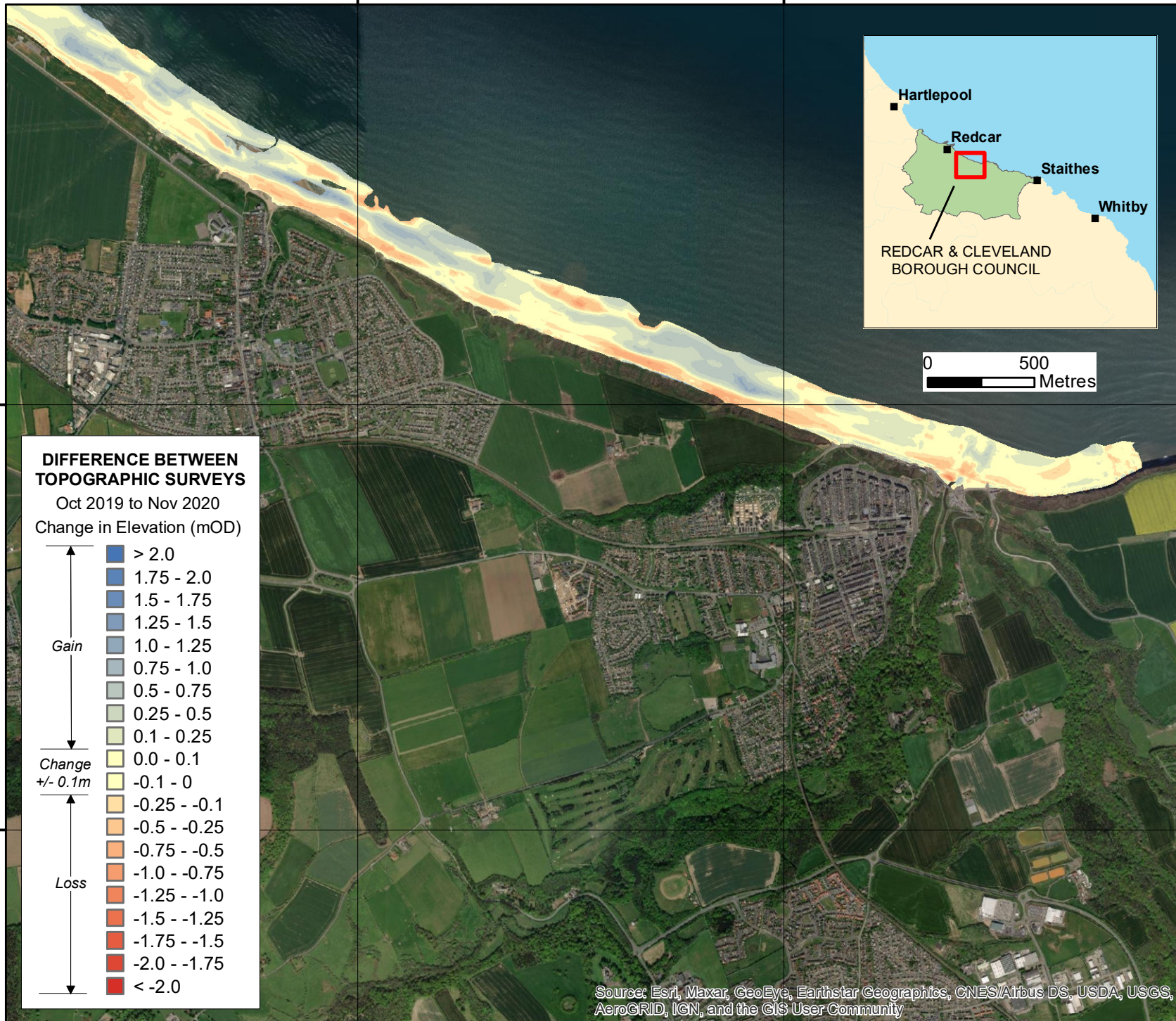


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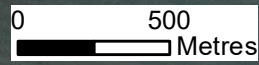
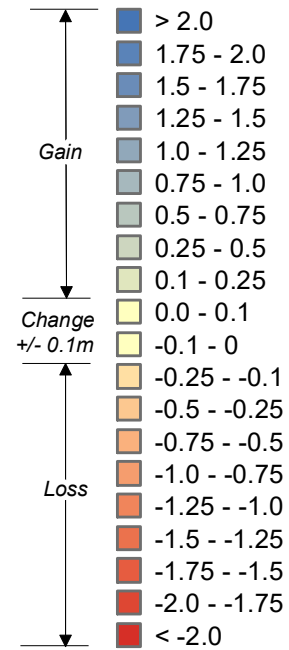
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466000



**DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS**

Oct 2019 to Nov 2020  
Change in Elevation (mOD)



Key

Client: North East Coastal Group  
Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 7**  
**MARSKE/ SALT BURN SANDS**  
**Redcar and Cleveland Borough Council Frontage**  
Analytical Report  
'Full Measures' Survey 2020

Drawing Scale at A4 1:25,000

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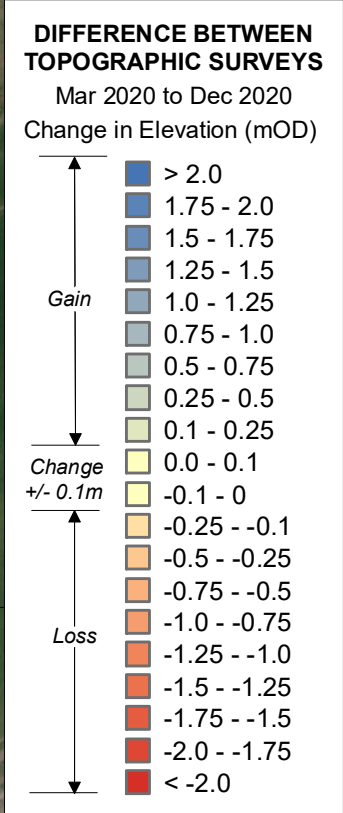
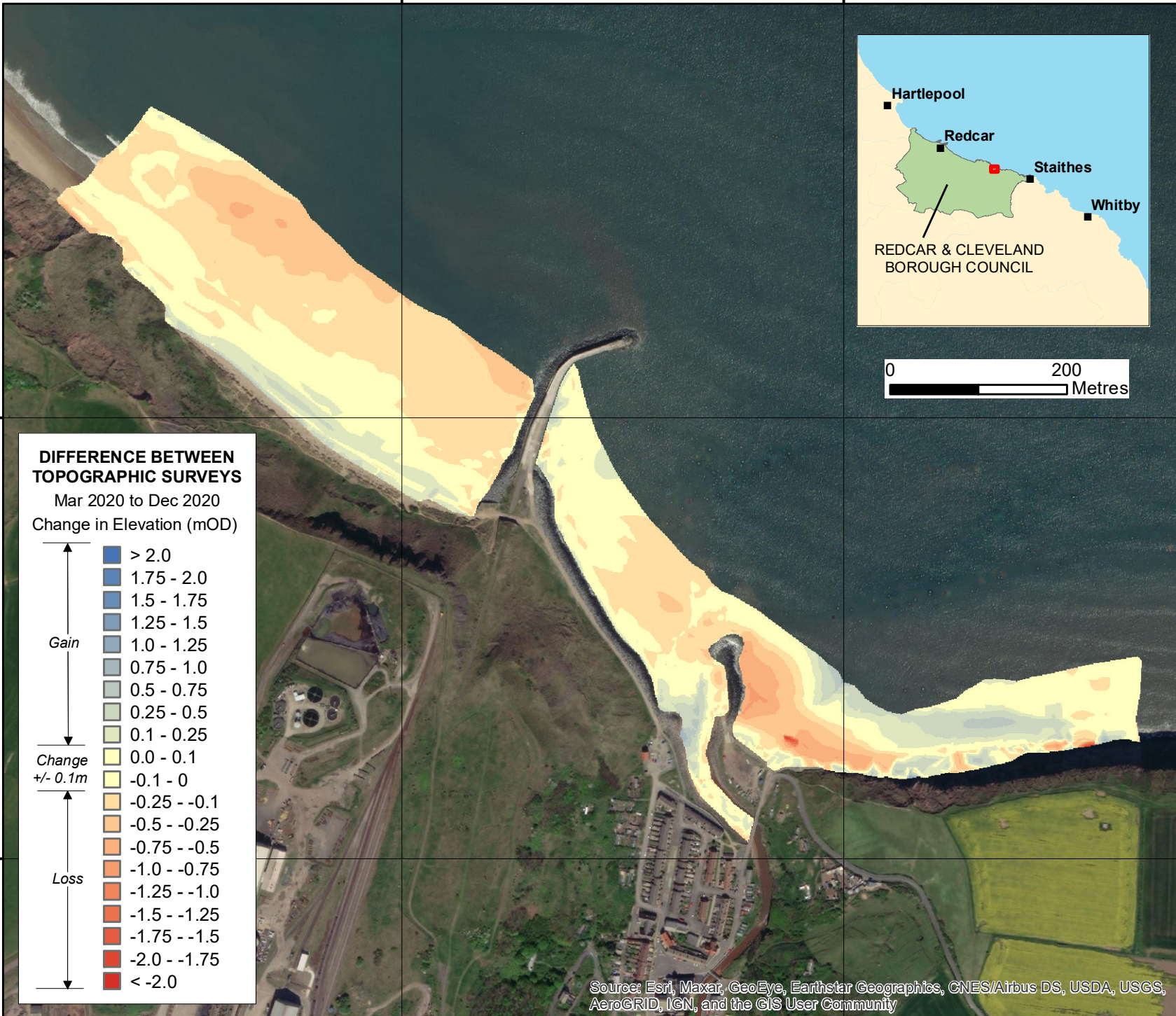
Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

520500

520000

471000

471500



Key

Client: North East Coastal Group  
Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 8**  
**CATTERSTY SANDS**  
**Redcar and Cleveland Borough Council Frontage**  
Analytical Report  
'Full Measures' Survey 2020

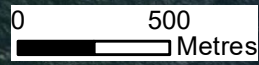
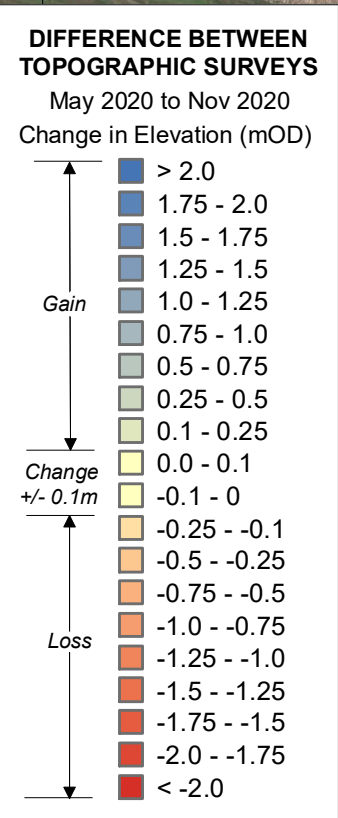
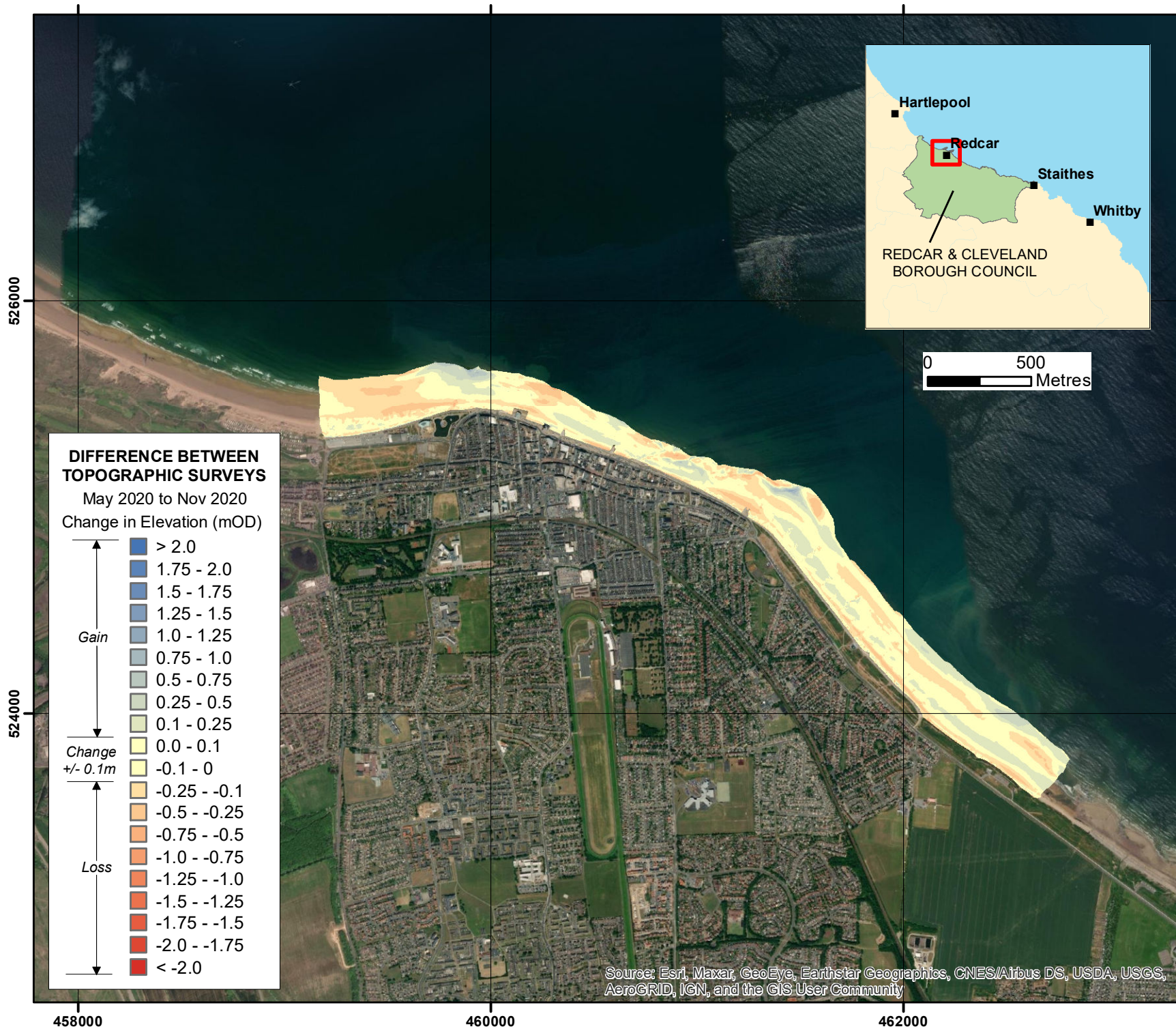
Drawing Scale at A4 1:6,000

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Key

Client: North East Coastal Group  
 Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 9**  
**REDCAR SANDS**

**Redcar and Cleveland Borough Council Frontage**

Analytical Report  
 'Full Measures' Survey 2020

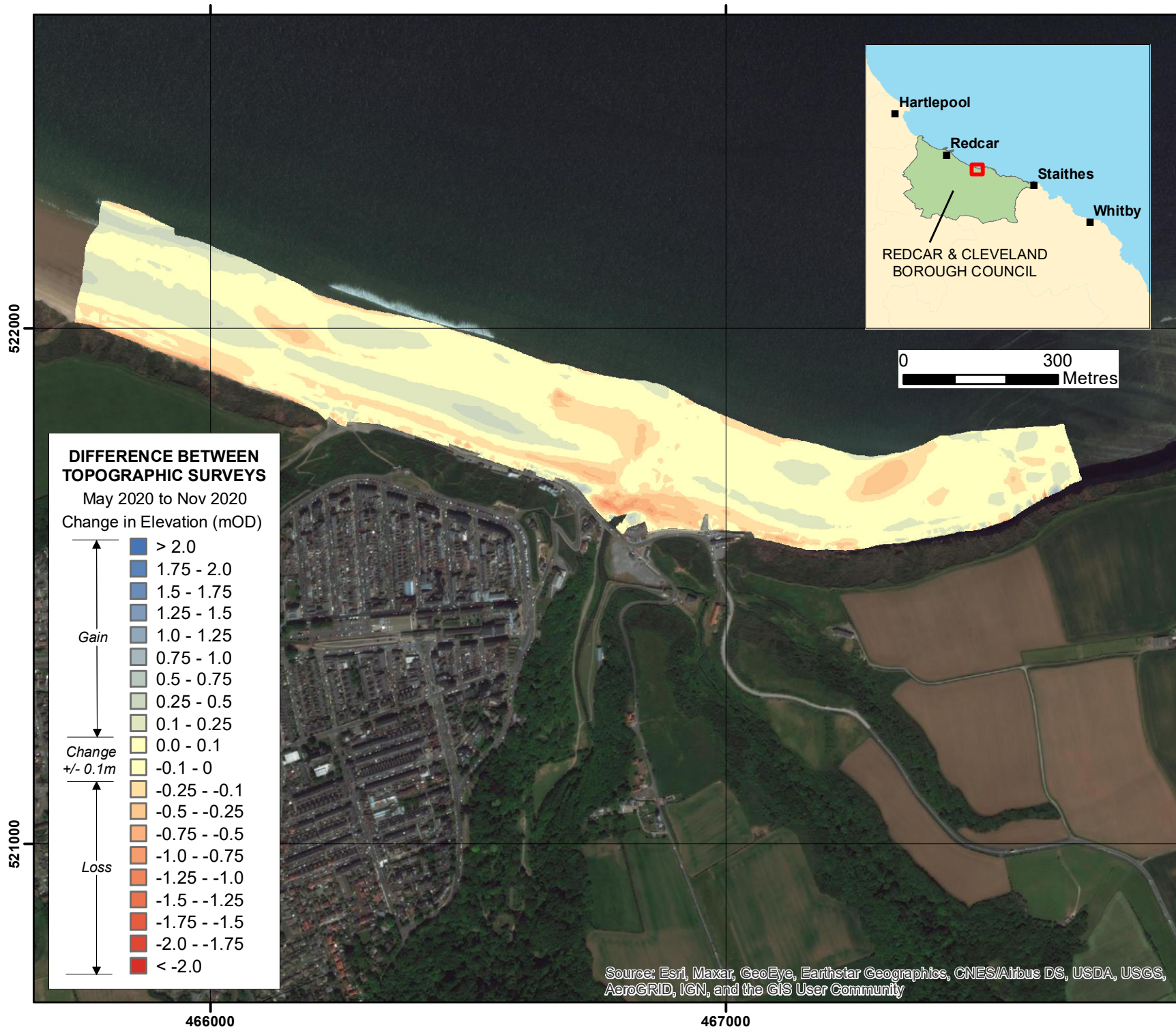
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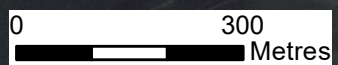
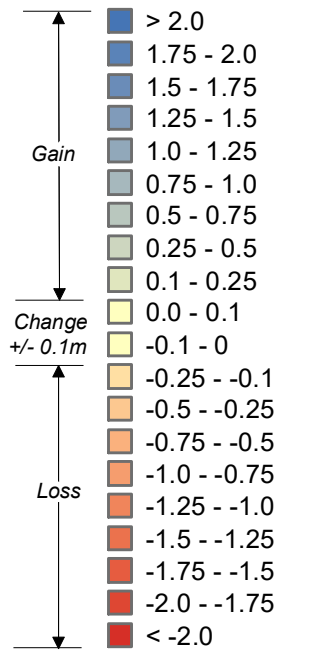


Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



**DIFFERENCE BETWEEN TOPOGRAPHIC SURVEYS**

May 2020 to Nov 2020  
Change in Elevation (mOD)



Key

Client: North East Coastal Group  
Project: Cell 1 Regional Coastal Monitoring Programme

**Appendix B - Map 10**  
**SALTBURN SANDS**  
**Redcar and Cleveland Borough Council Frontage**

Analytical Report  
'Full Measures' Survey 2020

Drawing Scale at A4 1:10,000

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

**Appendix C**  
**Cliff Top Survey**

## Cliff Top Survey

### Staithes

Twenty ground control points have been established within Staithes. The maximum separation between any two points is nominally 100m.

The cliff top surveys at Staithes are undertaken bi-annually. Measurements are taken from a fixed ground control point along a fixed bearing to the edge of the cliff top.

Table C1 provides baseline information about these ground control points and results from the 2008 (baseline) survey showing the position from the ground control point to the edge of the cliff top along the defined bearing. Future reports will show results from subsequent surveys and provide a means of assessing erosion since the baseline survey.

**Table C1 – Cliff Top Surveys at Staithes**

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
STAITHES							Nov 2008	March 2020	Nov 2020
1	477228	518769	320	1.90	-4.90	-5.21	7.11	0.31	0.59
2	477334	518798	0	10.90	10.66	10.57	0.33	0.09	0.03
3	477487	518789	350	7.10	8.00	7.99	-0.89	0.01	0.00
4	477594	518801	340	5.90	3.79	3.72	2.18	0.07	0.18
5	477683	518911	350	8.40	8.11	8.24	0.16	-0.13	0.01
6	477792	518867	30	8.60	8.50	8.32	0.28	0.18	0.02
7	477891	518828	60	7.70	7.29	7.20	0.50	0.09	0.04
8	477959	518873	350	8.70	9.50	9.43	-0.73	0.07	0.00
9	478088	518950	350	7.60	8.07	7.94	-0.34	0.13	0.00
10	478191	519023	340	8.40	9.59	8.48	-0.08	1.11	0.00
11	478237	519007	60	6.90	6.60	6.59	0.31	0.01	0.03
12	478213	518988	150	6.10	6.07	6.34	-0.24	-0.27	0.00
13	478501	518809	15	11.40	8.65	8.47	2.93	0.18	0.24

Ground Control Points				Distance to Cliff Top (m)			Total Erosion (m)		Erosion Rate (m/year)
Ref	Easting	Northing	Bearing (°)	Baseline Survey	Previous Survey	Present Survey	Baseline to Present	Previous to Present	Baseline to Present
STAITHES							Nov 2008	March 2020	Nov 2020
14	478624	518807	20	7.50	7.47	7.45	0.05	0.02	0.00
15	478737	518858	60	6.10	6.32	6.28	-0.18	0.04	0.00
16	478823	518757	60	8.00	8.46	8.30	-0.30	0.16	0.00
17	478944	518671	30	9.30	9.13	8.75	0.55	0.38	0.05
18	479052	518630	20	9.20	9.25	9.03	0.17	0.22	0.01
19	479147	518610	0	14.20	14.04	14.34	-0.14	-0.30	0.00
20	479274	518618	20	11.40	11.14	11.03	0.37	0.11	0.03

**Note:** It is assumed that the accuracy of cliff top monitoring using this technique is  $\pm 0.1$ m. Therefore, observed changes have been altered by this amount prior to calculation of an erosion rate. Erosion rates are not calculated where the cliff line shows advance. This is likely to be the product of differing survey interpretation, and far less likely to be a toppling cliff edge.

